The Geographical Journal

Vol. LXVI No. 6 December 1925

PREHISTORIC ROUTES BETWEEN NORTHERN EUROPE AND ITALY DEFINED BY THE AMBER TRADE

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Read at the Meeting of the Society, 9 February 1925. Maps follow p. 576.

I. Introduction.

APART from a few stray references we have no written records concerning Central Europe and its inhabitants before the time of Cæsar and Tacitus. To-night I hope to show that the study of prehistoric amber finds and their distribution casts no little light on the human geography of that region during the second and the last millennium of the pre-Christian era.

In prehistoric archæology, concerned as it primarily is with the more material aspects of civilization, the study of trade relations is of peculiar importance. Oskar Montelius, perhaps the greatest prehistorian the world has yet known, says: "The investigations of the last few decades have incontrovertibly proved that the culture of the inhabitants of Northern Europe, long before the beginning of our era, was uncommonly high. The explanation of this remarkable phenomenon is to be sought in trade, trade which, even in the remote periods with which we are concerned, was of a far greater significance than has hitherto been recognized' (*Prähistorische Zeitschr.*, 1910, pp. 249 ff.).

Sixty years of research have shown that, while Northern Europe may have had various raw stuffs at its disposal for purposes of bartering with the South, amber was the one distinguishable and *imperishable* substance which it exported on an extensive scale.

As natural deposits of amber are found in different regions, the first question is, what grounds have we for supposing that the many antiquities of this substance unearthed in Southern Europe are of northern origin?

The colour of a specimen is no criterion, for a great diversity of hues is found both in succinite (northern amber) and simetite (the Sicilian variety); furthermore, the action of certain soils tends to alter the original colour.

The evidence of classical authors is only slightly more satisfactory. Although they hold widely divergent views as to the locality from which this mineral came, they maintain a unanimous silence as to the existence of the Sicilian deposits. The explanation of the more fantastic statements by the ancients as to where amber was found is not due, as Pliny maintains, to the mendacity of the Greeks, but to more prosaic reasons. First, the Greeks' knowledge of geography was apt to be inaccurate when dealing with any region not in the immediate neighbourhood of their own land. Secondly, their ignorance was increased by reason of amber being no longer employed for ornamental purposes during most of the latter part of the first millennium B.C. in regions where the influence of Greek classical culture had become dominant. This interesting fact was established by Helbig in 1877.* When amber again came into fashion during the Roman Imperial Epoch, the accounts given in Latin authors of the places from which the supplies of this mineral were drawn are in every way clearer and more satisfactory.

The method of determining the provenance of amber antiquities by means of chemical analysis has been the subject of some controversy.† Although I have gone into this aspect of the problem at great length with an excellent chemist, time necessitates my making but the briefest allusion to it this evening. The question depends for the most part on the succinic or amber acid content. Natural ambers from the Mediterranean area and the regions that lie between it and the Central European mountain chains, with the single exception of rumanite (the Rumanian variety), contain none, or a comparatively low percentage of this acid. North of the above mountains, both inland and along the coasts, the deposits generally yield an amber which contains a relatively high percentage.‡ We have no evidence for assuming that the Rumanian deposits were worked in prehistoric times, that country and the adjoining territories being almost destitute of prehistoric amber antiquities. We must therefore suppose that only succinite or the local fossil resins were known to the then inhabitants of Southern Europe; but as the great majority of specimens of tomb-amber, found not only in Southern but also in Central Europe, have, on analysis, yielded a relatively high percentage of succinic acid, they would seem for the most part to be succinite and therefore to have come from the North. This variety of fossil resin is found over a wide area, extending from the eastern and southern coasts of England to the Gouv. of Vladmir in Russia. My

* *Atti de Acad. dei Lincei* (*Memorie*), 1877, pp. 425 and 427.

† *Schr. Naturforsch. Gesell. Danzig* i.–xvii.; A. B. Meyer, 'Gurina im Obergailthal,' pp. 80 ff.; J. Szombathy, *Zur Vorgesch. d. Bernsteins; Zeitschr. f. Ethnol.*, 1901, pp. 400 f. and *ibid.*, 1904, p. 153 ff.; *Schr. Physikalisch Oekonomische Gesell. Konigsberg*, 1908, pp. 352 ff.; and *Anzeiger f. Schweiz. Altertumsk.*, 1916, pp. 169 ff. Antoniewicz, *Pochodzenie i Gatunki Burstynu w Europie* (with French *résumé*), 1924.

‡ *Zeitschr. f. Ethnol.*, 1904, pp. 153 ff.; *Schrift. Naturforsch. Gesell. Danzig*, i.–xvii.

researches and those of others show that apart from East and West Prussia and the west coasts of Jutland, they are for the most part sporadic, and cannot be said to have played any great part in trade, at all events until a comparatively recent period.

The last method of testing whether and if so by what direction amber came from the North is by tracing a succession of finds in which objects of this substance occurred, from Northern across Central Europe down to the Mediterranean area. As this has been the most neglected of the above-mentioned tests I shall concentrate upon it for the greater part of this paper, taking into account any other evidence that has a bearing upon the subject.

As for the traffic in amber during the Neolithic Period and Copper Age, time will not allow us to discuss it to-night. All I can say is that the evidence is not at present sufficient to warrant the assumption that there was a transcontinental trade in amber, prior to the Bronze Age. If Northern amber was finding its way to the Mediterranean before that epoch it must have come by sea. A maritime route between the British Isles and the Iberian peninsula was, it is generally admitted, in existence in very early times. The idea of building megalithic tombs was probably brought into these islands from Spain (by way of Brittany), and the introduction of the flat axe seems to have come from the same direction. In spite of the sporadic occurrence of natural amber on the east coast of England, it is not improbable that these islands also drew their supplies from abroad.* Montelius has shown that, as far back as the Late Stone Age, a lively commerce existed over the North Sea between England and Scandinavia. The possibility of Northern amber reaching the Iberian peninsula is not therefore as strange as it might seem at first glance. Amber occurs on two calcholithic sites: twice at Alcalá (South Portugal) and once at Los Millares (South-Eastern Spain). It has also been found on two early sites in the East Mediterranean region.†

From its sporadic occurrence both in the latter area as well as the Iberian peninsula, it cannot be said to have played a leading part in trade, as far as Southern Europe was concerned, during the Late Stone and Copper Ages.

II. Central Routes.

1. *Early and Middle Bronze Ages.*

Having dealt with the preliminary problems, let us now turn to the history of this trade in the Bronze and Early Iron Ages. I have divided

* 'Brit. Mus. Bronze Age Guide,' p. 108.

† In an Early Minoan burial at Kumasa, Crete ('Mosso, Origini,' p. 290) and in a Neolithic grave at Corinth (Nansen, 'Northern Mists,' 1, p. 14). The amber also occurs at Bisceglie (von Duhn, 'Italische Gräberkunde,' 1, p. 46) and Castelluchio (*Bull. Paletnol. Ital.*, 1887, p. 23); the former may date from the Copper Age, the latter from Orsi I.

the different systems of routes into three main groups (see Plate 1): the Central, the Western, and the Eastern. The amber which travelled along the Central and Western routes came from Jutland, while the Eastern route drew its supplies from the East Baltic deposits. I shall begin with the Central System, as I believe it to be the oldest of the three. We shall then pass to the Western routes, and finally to the Eastern, which opened at a later date than either of the others.

During the Neolithic Period Denmark and the neighbouring regions were very rich in amber objects; but during the Bronze Age there was a marked falling off in this respect. The cause of this decrease has been ascribed by Montelius and other leading Scandinavian and German archæologists to the opening of the transcontinental trade between Northern Europe and the Mediterranean region. When the then inhabitants of Denmark, etc., realized the purchasing power of this material which lay so close to hand, they naturally exported all they could to the South, acquiring in exchange for it metals and other minerals they could only obtain by importation.

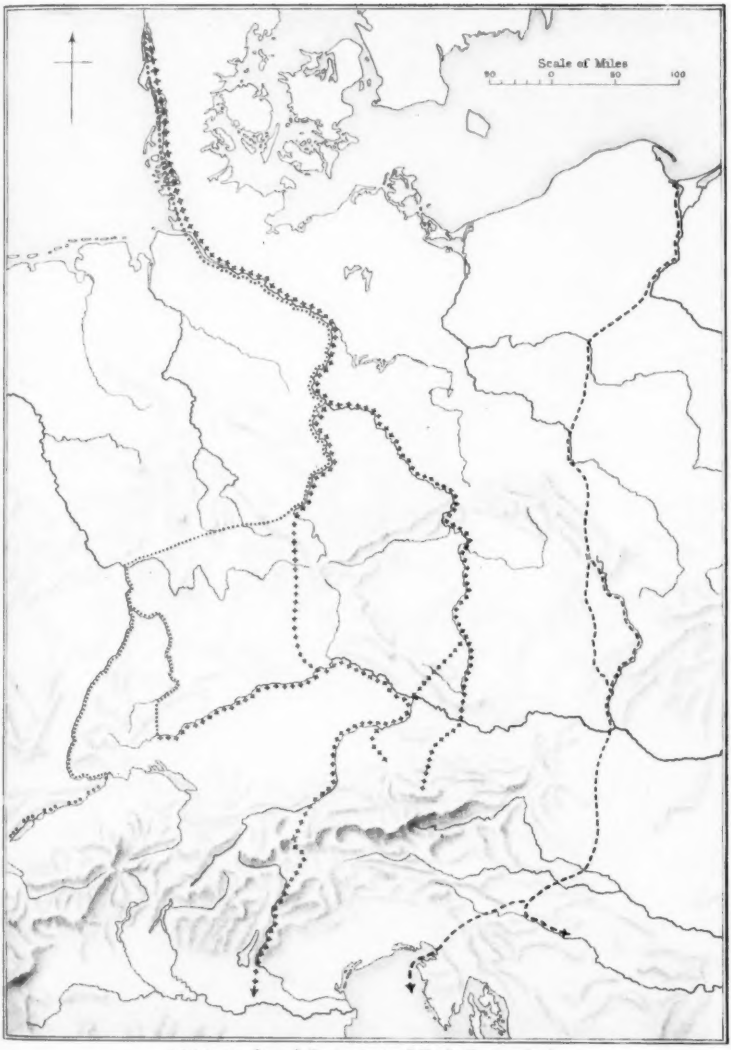
Generally speaking, rivers may be said to have played a large part in transmission of cultures from one region to another by means of trade; but it does not necessarily follow that every great river was a high-road of commerce.

During the Bronze Age, objects of Italian manufacture are well represented in South Sweden, Denmark, Schleswig-Holstein, and Mecklenburg, but in pre-war Eastern Germany their occurrence is far more rare. This and other reasons have led archæologists to believe that it was the Jutland, not the East Baltic, deposits that first furnished Southern Europe with its amber supplies.

In an article on prehistoric trade (*Prähist. Ztschr.*, 1910, pp. 249 ff.), Montelius, largely basing his evidence on the distribution of Italian bronzes found in Northern and Central Europe, traces a route right across the continent, from South Sweden and Denmark to Italy. It corresponds more or less with our above-named Central System, based upon my amber statistics.

According to Montelius a route left Jutland and passed up the Elbe as far as the confluence of that river and the Saale. Here it bifurcated; the more eastern branch continued up the Elbe into Bohemia as far as Melnik. At this point it left the Elbe and passed up the Moldau, until crossing the Böhmer Wald, it struck the Danube opposite Linz. It proceeded up the latter river as far as Passau. The western branch passed up the Saale and over the Thüringer Wald through Bavaria until it struck the Danube opposite Passau. After the junction of these two branches at Passau the route made its way up the Inn, till turning southward, somewhere near Innsbrück, it crossed the Alps by the Brenner Pass, and reaching the Adige entered Italy.

According to the distribution of amber finds (see Map I.), Montelius'



++++ = *Central Routes (opened Early Bronze Age)*
..... = *Western Routes (opened Middle Bronze Age)*
– – – = *Eastern Routes (opened Early Iron Age)*

TRANS-CONTINENTAL AMBER ROUTES

view of the point where the western branch of the Central Route struck the Danube seems to require slight modification. It would appear to have first reached that river at Kehlheim, rather than Passau. My statistics point to two further developments in this Central System: a south-western extension up the Danube into Würtemberg, and an extension into Upper Austria.* These will be dealt with in their proper places.

I intend going at some length into the question of the Central System of routes and whether northern amber reached Italy by them during the Bronze Age. M. Viollier and others would have us believe that this process was reversed, Apennine or Sicilian amber being exported northward, not succinite finding its way to the South.

Let us proceed southward step by step, and see whether the evidence favours this hypothesis or not.

During the Early and the Early Middle Bronze Age, in Northern Bohemia and the neighbouring regions we find a common culture which goes under the name of the Aunjetitz civilization. It is characterized by inhumation graves containing skeletons buried in a contracted position. Among the Aunjetitz metal antiquities found in North Bohemia and the adjoining districts are many objects of adornment made of the so-called "metal blanc." These, on analysis, were found to contain a relatively high percentage of tin, the actual figures ranging up to 25 per cent.† In view of this it seems probable that the rich tin ores in this region were exploited by its Early Bronze Age inhabitants.

Tin, needless to say, was of the greatest importance during a period when bronze was the principal metal in use; and one of the reasons why Bohemia played a vital part in the history of commerce during that period was apparently owing to its richness in tin. But the Elbe also was an important factor. The amber-yielding coasts of Jutland lay at no great distance from the mouth of this river, and the sources and upper reaches of the Elbe lay in Bohemia. The Elbe, therefore, formed a direct link between Jutland with its amber and Northern Bohemia with its tin. As no ingots of tin have been found in Northern Europe, it is presumed that the metal imported had already been alloyed.

In studying the contents of the Aunjetitz graves at the National Museum in Prague, one cannot help being struck by two features: the frequency with which objects of amber appear in them (there is hardly an important Aunjetitz burial-ground in North-West Bohemia that has not yielded antiquities of amber), and the numerous small spiral rings of gold wire they contain. Not infrequently have amber and these rings been found in the same grave. The gold is generally thought to have

* A further route passed up the Isar, but this seems only to have been of importance as far as Upper Bavaria was concerned.

† Schránil, 'Studie o vzniku kultury bronzové v Cechách,' pp. 101 f.; and oral communication from Dr. Schránil.

come from Transylvania, one of the chief gold centres of prehistoric Europe. It was from this region, too, that the rings with overlapping extremities, which originated in the Ægean area, were introduced into Northern Bohemia (Schránil, *l.c.*, p. 98).

I do not know of any amber finds of this early period occurring in Transylvania, but large numbers of these gold wire rings have been brought to light in the vicinity of the amber-yielding coasts of Jutland (Müller, 'Nord. Altk.,' I, 323). The connection between Jutland and Transylvania can hardly therefore have been a direct one. Seeing that the above rings are found associated with amber in North Bohemian Early Bronze Age graves, one can only conclude that the then inhabitants of that region imported gold from the South-East, and exchanged part of these imported supplies with the North in return for Jutland amber. An important link in the Early Bronze Age amber trade between Jutland and North Bohemia is the hoard from the Waudener Flur, Jessen Nr Lommatzsch (Kingdom of Saxony),* where a large quantity of amber antiquities were found with objects characteristic of the Early Bronze Age. A flat amber "centre-piece" with transverse boring came to light on this site (*Sitzber. Isis*, 1884, p. 76). It seems clear, therefore, that the Early Bronze Age amber trade extended as far south at any rate as Northern Bohemia. In Southern Bohemia, even along the river Moldau, no amber occurs prior to the Middle Bronze Age. But this was only to be expected, as South Bohemia was not inhabited during the Earliest Bronze Age. Nevertheless, the fact of six out of the seven Aunjetitz hoards, brought to light in this region, being found in the vicinity of the Moldau, proves that although South Bohemia was a wild and uninhabited tract, traders were already passing along the banks of that river.†

Let us now turn to the western branch of the Central Route that left the Elbe and passed up the Saale. In the southern half of the Province of Saxony an important hoard was brought to light near Dieskau (south-east of Halle). Here, with various bronzes characteristic of the Early Bronze Age, over 120 pieces of amber were brought to light, among them flat centre-pieces (axe-shaped, and rectangular with rounded corners) with transverse borings.‡ North of the Thüringer Wald amber also occurred in a grave of the Earliest Bronze Age at Apolda.§ Further to the west lies Seebergen (near Erfurt). Here amber was found in an inhumation burial which may also date from the Early Bronze Age, but the account of the excavation is far from satisfactory. ‖ More important

* Montelius, 'Chronol. d. ältest. Bronzezeit,' pp. 40 f.

† From a map in the National Museum at Prague showing the distribution of objects of the Aunjetitz culture in Bohemia and Western Moravia.

‡ *Jahresschr. f. d. Vorgesch. d. sächsisch. thüring. Lände*, iv. (1905) pp. 8 f. and Plate I., fig. 4.

§ 'Vor- und frühgesch. Altertümer Thüringens,' p. 290.

‖ *Ibid.*, p. 240.

than either of these are the two graves containing amber from the Early Bronze Age burial-ground at Straubing (Lower Bavaria).* First, they show that even in the Early Bronze Age (and the latter part of that period in Bavaria would synchronize with a very remote phase of the Danish Early Bronze Age) the amber trade had begun to penetrate as far south as the Danube. Secondly, these finds at Straubing prove that amber was passing south along the Central System somewhat before it began to find its way up the Western Route proper, for amber does not seem to have been known in Western Germany until the beginning of the Middle Bronze Age.

South of the junction of the eastern and western branches of the Central Route at Passau are several other finds of interest, notably that of Ried in the Upper Inn Valley (Tyrol), which is one of the most important that have yet been made in connection with our subject.† Although the *Upper* Inn Valley does not actually lie on the main route to Italy it has immediate access to it, for the main route, after leaving the Danube, passes up the Inn as far as the region of Innsbruck.

Here certain antiquities of bronze were found in association with amber. The former included a sword (Naue type III.), an *ösenring*, a flanged axe with notched helving-end, and several bronze wire spiral *tutuli*. Naue assigns the sword to the Middle Bronze Age. But the presence of such Early Bronze Age types as the axe and the *ösenring* would show the find to date from a very early phase of the Middle Bronze Age—at a time when the Early Bronze Age was still dominant in Northern Europe. It is significant that a sword similar to the one found at Ried (and the type is by no means a common one) came to light at Neuendorf in Pomerania. But more important still is the evidence of the amber itself. Among the objects of this substance discovered at Ried is a flat centre-piece with vertical boring. As long ago as 1882, this type was shown to have originated in the West Baltic—Jutland area, where it can be traced back to Neolithic times.‡ On the other hand, no such amber object has been found associated with Bronze Age antiquities in Italy or Sicily. The presence, therefore, of a specimen in this find from Ried goes far towards proving that amber of northern provenance was at all events reaching the Tyrol shortly after the Middle Bronze Age became dominant in that district at a time when the Bronze Age of Northern Europe was still in its childhood. An almost identical centre piece was among the antiquities of the above-mentioned hoard from Dieskau (*supra*, p. 486), and what would appear to be a very similar one was found on the Waudener Flur, Jessen (*supra*, p. 486). Similar objects were by no means unknown in Southern Germany during

* Behrens, 'Bronzezeit in Süddeutschland,' p. 66; and *Beitr. zur Urgesch. Bayerns*, 15, p 175.

† 'Naue, Vorrömische Schwerter,' p. 34, pl. xli. figs. 1–7.

‡ Klebs, 'Bernsteinschmuck in der Steinzeit,' pp. 24 and 26. See also Olshausen, *Zeitschr. f. Ethnol.*, 1891, p. 306.

the Middle Bronze Age, and they also occur in the Aunjetitz burials of Northern Bohemia.

We have mentioned that the Central Route crossed the Alps by way of the Brenner Pass. In this connection we have still to mention a find made in the year 1867, directly over the Mühltal tunnel, which lies near Matrei about half way between Innsbrück and the Brenner. On this spot a fine specimen of a so-called "terramare dagger" was brought to light.* The significance of this find lies not only in the locality where it occurred, but in the fact that this type of dagger was the most important Early Bronze Age object of Italian origin that reached Central and Northern Europe. This is manifest by the widespread distribution in those regions both of the original model and the barbaric copy.

Another find of interest was made, this time in South Tyrol. Although the actual site is unknown, there is no doubt that it was discovered in this region. The object in question is part of a fibula of primitive northern form,† a type which seems to have originated in Schleswig-Holstein and Denmark shortly after the beginning of the Middle Bronze Age. With a further exception, soon to be mentioned, this brooch is quite isolated and altogether unknown both in the Tyrol and in the regions that lie further to the south.

After passing along the Eisack our route entered Italy by way of the Adige. A short distance to the west of the river lies the Lake of Garda, on whose southern shores is situated the celebrated lake dwelling near Peschiera. Here two bronze pins were brought to light, each with a bead of yellow amber for its head.‡ The latter have, unfortunately, not been analysed, but I know of two sites in Bavaria where pins of a similar type to those from Peschiera have been found: Brunn in the Upper Palatinate (*Beitr. z. Urgesch. Bay.*, 15, p. 177) and Mischelbach in the Middle Franconia (Behrens, *l.c.*, p. 145) both date from the Middle Bronze Age. The examples from Peschiera are the only specimens of this type hitherto discovered in Italy.

Further to the south we have the fragment of a brooch unearthed during the excavation of the terramare at Servirola, near San Polo D'Enza in the Province of Reggio (Kossinna, *l.c.*, p. 115, fig. 233). It is a northern fibula of a slightly more developed variety than the one just mentioned as being found in South Tyrol. As a type it is quite foreign to Italy; common to Northern Europe, it is best represented in Jutland. It dates from the Middle Bronze Age. Within 20 to 30 miles of Servirola there are three Bronze Age sites that on excavation have yielded objects of amber: Gorzano, Montale, and Casinalbo.

From the chemical experiments of Dr. Reutter,§ to which I shall refer later, it would seem that Italian amber deposits were exploited

* Montelius, *Svenska Fornminnesföreningens Tidskr.*, xi. p. 101.

† Kossinna, 'Deutsche Vorgesch.,' 3rd ed., pp. 115 f., fig. 234.

‡ Montelius, 'Civiliztn. primit. en Italie,' Series B, Texte p. 53, pl. 7, fig. 18.

§ *Angzeiger f. Schweiz. Altertumsk.*, 1916, pp. 169 ff.

in the Early Iron Ages; but it has not yet been proved that they were worked in the Bronze Age. As only one Bronze Age amber bead from Italy seems to have been analysed,* chemistry at present affords us no aid in determining whether this was so or not. In view, however, of the northern amber in Bohemia, the northern centre-pieces from Central and Southern Germany and from Ried, the pins from Peschiera, and the northern fibulæ from South Tyrol and Servirola, not to mention the whole succession of amber finds stretching from Denmark right across Europe to Upper Italy, I think we may confidently state that even if the Italian deposits were exploited as early as the Bronze Age, northern amber was also reaching Italy at this period.

Mention is still to be made of a south-western extension of the Central Route, which seems to have turned off from the western branch of the Central Route in the region of Kehlheim and passed up the Danube into Würtemberg. In the Hallstatt Period this is better defined; but in view of the extraordinary richness of Danubian Würtemberg in Middle Bronze Age amber antiquities, and also of an important Middle Bronze Age amber find at Essingen Lauterburg (Behrens, *l.c.*, p. 167), which lies near a main road leading from the Danube across the Schwabian Jura, it seems probable that our mineral may have been brought down this extension before the beginning of the Iron Age. Traders were passing up and down this region in the Early Bronze Age, although, from the statistics I have collected, amber does not seem to have played any great part in their dealings prior to the middle phase of that Epoch.

Time only permits my making a passing allusion to the amber finds in Silesia. They occur in Aunjetitz burials, and in my opinion reached that province by way of Northern Bohemia. In graves of the Middle Bronze Age amber antiquities are by no means common, but in the Early Iron Age they again come into prominence (*e.g.* the great amber find from Hennersdorf).†

Objects of amber dating from the Early Bronze Age in Moravia are very rare indeed. Here, as in Silesia, they are only found in Aunjetitz burials. Červinka and other well-known Czecho-Slovakian archæologists agree in holding that before coming into Moravia they must have passed through Bohemia. I know of no amber that has been found on Moravian Middle and Late Bronze Age sites.

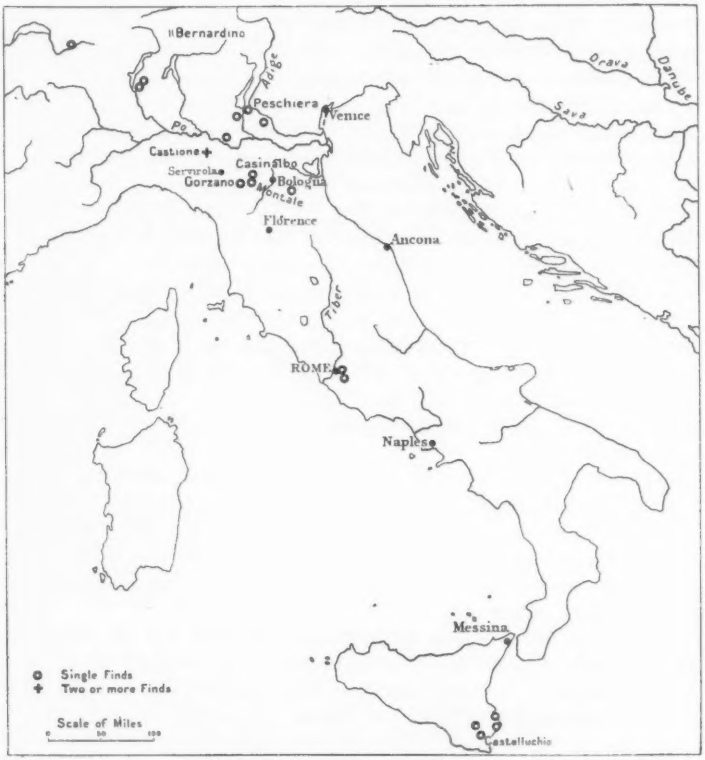
2. *Late Bronze Age.*

In speaking of the Late Bronze Age amber traffic along the Central Route, I must limit myself to a few remarks which apply to the history of our trade in general during those times.

* *Zeitschr. f. Ethnol.*, 1891, p. (291). The specimen in question came from the terramare at Castione (Parma). From the figure obtained (taking the totality of the amber as basis) it might either be succinite with a somewhat lower percentage than usual, or southern amber with an unusually high percentage of amber acid.

† *Archiv. f. Anthropol.*, 1867, pp. 111 f.

One cannot help being struck by the paucity of amber finds during this epoch as compared with those of the Middle Bronze Age and the Hallstatt Period. At first glance this would seem to point to a marked decrease in the trade during the Late Bronze Age. But the figures are deceptive. We must remember that, from the Alps northward, this was a period in which the custom of cremation prevailed, and the reason why Late Bronze Age graves were apt to be poorer in all things, saving



Bronze Age "Amber finds" in Italy.

pottery, was that the trappings of the dead were frequently burnt with them.* We should also remember that, apart from pottery, our knowledge of the material civilization of the Late Bronze Age is mainly

* This may also have contributed to amber being so rarely found in burials of the Early Iron Age in North-West Germany (see also *infra*, p. 492). This does not apply to West Prussia, etc., where beads of amber on bronze rings are frequently found in the ears of face-urns.

derived from hoards, and that amber antiquities, on the other hand, are seldom found except in graves.

Already during the Aunjetitz period a form of necklace was worn in Central Europe which consisted of two or more rows of amber beads strung together on one or more plaques of the same material, with a corresponding number of borings. During the Middle Bronze Age they become more common. Although this highly developed type of ornament does not appear in graves of the Late Bronze Age, it is found in Bavaria and at Hallstatt itself during the Hallstatt Period, while plaques with transverse borings occur on Hallstatt sites in South Germany and what was once Austria. The survival of this type of ornament is to my mind another argument against any interruption in the amber trade having taken place in the interim between the Middle Bronze Age and the beginning of the Hallstatt Period.

We should also remember that Italian imported objects, found in Northern Europe, occur in greater numbers during the Late Bronze and Earliest Iron Ages than in the Early and Middle Bronze Ages. The same is true for bronzes of northern manufacture found in Central Europe.

Finally, there was a considerable chronological overlap between the Late Bronze Age in the North and the Early Iron Age in Upper Italy. By the second phase of the latter (*circ.* 900–750 B.C.) amber began to be employed in Italy on a larger scale than it ever had been before, and the great majority of specimens of this amber which have been subjected to chemical analysis, have been shown to be of Northern origin (see Figs. 1 and 2).

In view of all this evidence, it is most unlikely that any break in the amber trade took place in the period between the end of the Middle Bronze Age and the beginning of the Early Iron Age.

3. *Iron Ages.*

By the distribution of finds on Map II. one can see that amber in the Hallstatt Period found its way South along the Central Route System much in the same way as it did during the Bronze Age—with one or two differences.

Northern Bohemia since the Early Bronze Age had undergone two invasions: one during the later half of the Bronze Age, from the North; and one at the end of that period from Silesia ('Buchtela, Vorgesch. Böhmens,' p. 35). The rite of cremation was introduced by the former, while the latter, also a cremation people, brought with them a knowledge of iron. This second wave of invaders drove those of the preceding wave who had settled in East Bohemia westwards, taking this newly conquered region to themselves. It may possibly have been owing to these warlike conditions that the eastern branch of the Central Route, passing as it did through Bohemia, had come to be of lesser importance

than it was in the more peaceful Aunjetitz days: a mere glance at the map will show the decrease in the number of amber finds in North Bohemia as compared with those in the Early Bronze Age. Along the western or Bavarian branch, during the Hallstatt Period, our trade continued undisturbed.

There is one important development in this Central System of routes during the Earliest Iron Age, and that is the opening of an extension into Upper Austria.

With the exception of the Tyrol no amber objects of the Bronze Age have yet been found in Austria. By the opening of the Iron Age they suddenly appear in large quantities at Hallstatt itself, while amber dating from this period has also been unearthed near Hallein. How and why, then, did amber reach these places? Let us deal with the latter finds first. After leaving the Danube at Passau and turning up the Inn the route passed up the latter river until it reached the place where its waters were joined by those of the Salzach. Here it would appear to have left the Inn and proceeded along the latter stream past Salzburg and Hallein. Whether amber found its way further to the south along this route I am not at present able to say; but near Hallein stands a hill called the Dürrenberg, in which a prehistoric salt-mine was discovered. A number of graves have been excavated in the immediate vicinity, amber being discovered in several of these associated with objects of a Hallstatt and La Tène character.*

Owing to the almost complete lack of prehistoric finds in the Lammerbach–Pass Gschütt–Gosau region, I think it more probable that amber reached Hallstatt from the North direct, along the banks of the swift-flowing Traun, and not from the above-mentioned Salzach route. The occurrence of amber finds, dating from the Hallstatt Period, at Linz † and at Wels lends colour to this view.

We have not far to go to find the reason which caused this south-easterly deflection from the river Inn. It was due to the growth of the ancient salt industry. This region, which as far as Hallstatt finds are concerned is one of the richest in Central Europe, abounds in salt. We have already alluded to the Dürrenburg; a prehistoric briquetage was discovered at Reichenhall (15 km. N.N.W. of Hallein); while the reason why Hallstatt itself was so rich in antiquities was in all probability due to the salt-mine in the immediate vicinity of the celebrated burial-ground, which, possibly exploited as far back as the Bronze Age, continued to be worked into the Hallstatt Period.‡

* *Jahrbuch. f. Altertumsk.*, 1913, pp. 19 f., 24 f., 29 f., and Notes in the Naturhistorisches Museum, Vienna.

† *Wiener Prähist. Ztschr.*, 1924, p. 69 (Linz). Theuer, *Urgesch. Oberösterrichs* (1925), p. 47 (Wels).

‡ In the late Hallstatt and La Tène Periods salt was extracted from water both at Hallstatt and Hallein (oral communication from Dotctor Mahr, and Andree, 'Berg bau in der Vorzt,' p. 63).

We have still to determine what phase of this period amber first found its way into Upper Austria. Judging from the graves at Hallstatt itself it must already have been common in these parts before the year 700, for it was frequently to be met with in the early graves of this famous site, which according to Hoernes date from the ninth and eighth centuries B.C.

Early Iron Age "Amber finds" in Italy.

I do not wish to convey from the above that the old route was eclipsed by this new extension, for, as we have already seen, northern amber was at this time reaching Italy in greater quantities than it had ever done before.

During the La Tène Period the amber trade along the Central System, as far as the South was concerned, began to diminish in importance, reaching its nadir in the last three centuries of the pre-Christian era.

III. The Western Routes.

1. *Bronze Age.*

Having dealt with the Central System, its main branches and their extensions, let us now turn to the Western Routes.

In the *West Deutsche Zeitschrift* for 1901 (pp. 192 ff.), Schumacher speaks of an "amber route" passing South-West over the Elbe and Weser regions till it struck the Middle Rhine, along which river it passed up into Switzerland, from that country eventually entering Italy. Judging from my statistics, I should be inclined to doubt if the route that cut across the Weser was of great importance as far as the amber trade was concerned, and in view of more recent research I should certainly hesitate before saying it passed as far south as Italy.

In a more recent work * Schumacher gives a map marking the distribution of Bronze Age hoards in Western Germany. Thanks to his courtesy I am able to show it on the screen. (The distribution of hoards is of importance, for by it we can follow the routes taken by the old workers and traders in bronze weapons, implements, objects of adornment.) Here we can trace a succession of hoards stretching along the Rhine as far as Mainz, and then turning eastward through the Southern Wetterau. From here they branch out in two directions, one towards Thuringia and the Elbe, the other towards the Weser. The latter does not seem to be of great importance as far as Bronze Age amber is concerned, but keeping the Thuringian branch in mind, let us turn to my map No. I. showing the distribution of Bronze Age amber finds in the same region. The coincidence in the area of distribution of the hoards on the one hand and the amber finds on the other is remarkable, all the more so as amber is rarely found in hoards, but nearly always in graves.

This "amber route" therefore appears to have left Jutland and passed up along the Elbe until, leaving that river, it turned up the Saale. So far it followed the same track as the western branch of the Central Route. But in the Thuringian region it turned off in a westerly direction, probably on a line through Meiningen and then Fulda. Here it veered round to the South-West until it struck the Main near Hanau and eventually met the Rhine. It proceeded along this great stream as far as Mannheim, where it bifurcated, one branch continuing up the Rhine, the other turning up the Neckar through Northern Baden into the heart of Würtemberg, until, leaving this river and striking across the south-western end of the Swabian Jura, it met the upper Danube.

All the beads hitherto analysed which have been found in prehistoric burials in Würtemberg—Bronze Age, Hallstatt, and La Tène Period

* 'Altertumer unserer heidnisch. Vorvarh.,' 5, pp. 133 ff. A later map still will be found in Behrens, 'Bronzezeit in Süddeutschland,' Taf. II.

alike—yielded a high percentage of amber acid, and must therefore be of Northern origin.*

One cannot help being struck by the richness of this province in amber finds, especially in the Middle Bronze Age. Apart from North Bohemia, objects of this substance, dating from the Bronze Age, are better represented in Danubian Würtemberg and the districts immediately adjoining it than in any other part of Central Europe. This would seem to be due to the latter region being the converging point of two routes—the south-western extension of the Central System and the Eastern branch of the Western Route.

As a point of chronological interest, it should be stated that up to the present no amber object seems to have been found in Western Germany in burials prior to the beginning of the Middle Bronze Age. It would therefore seem probable that the Western opened at a slightly more recent date than the Central Route, for along the latter, both at Straubing in Bavaria, and in certain graves in the Saxo-Thuringian area and Northern Bohemia, amber was found associated with objects of purely an Early Bronze Age character.†

We have traced the Western Route as far south as Danubian Würtemberg; but did it extend any further southward than this? Was it one of the great transcontinental "amber routes"? Recent chemical research by Dr. Reutter of Geneva University has shed some light upon this question.‡ Reutter subjected a series of amber beads to analysis; all of those which had been found in Switzerland associated with antiquities of the Hallstatt and La Tène Periods proved to be of Southern, not of Northern, provenance. Two further beads were analysed which had been discovered at a lake-dwelling; they also were of Southern origin, but as no indication is given either as to the name of the lake-dwelling in which they were brought to light, or as to the period to which they belong, they are valueless as far as evidence is concerned. The others all dating from the Hallstatt and La Tène Periods, we cannot say for certain whether Northern amber was reaching Switzerland or not by the Western Route during the Bronze Age. The presence, however, of a fibula and a bronze "hanging vessel"—both Late Bronze Age types of undeniably Northern origin—among the antiquities from the lake-dwelling of Corcellettes is of considerable interest,§ for amber beads were found at the same station.‖ In view of this, it does not seem unlikely that amber from the North may have been worn by the lake-dwellers of Switzerland in the Bronze Age. Corcellettes is situated on

* Antoniewicz, *l.c.*, p. 17.

† The later Aunjetitzer period synchronized in part at least with the earlier part of the Middle Bronze Age in Southern and Western Germany.

‡ See *supra*, p. 488, footnote §.

§ *Congrès Internat. d'Anthropol. Monaco*, 1906, **2**, p. 248, and figs. 159 and 160 (p. 243).

‖ Munro, 'Lake Dwellings of Europe,' p. 58.

the shores of the Lake of Neuchatel, and the river Aare would form a connection between those districts of Switzerland and the Rhine. Furthermore, objects of a Swiss character have been found along the route traced by Schumacher in his map of the distribution of Bronze Age hoards in Western Germany (*l.c.*, vol. 5, p. 142).

Whether (as far as amber was concerned) the Western Route affected Italy during the Bronze Age is difficult to say. While we have no evidence that the Italian ambers were known, far less exploited, during the Neolithic and Calcholithic epochs, we have seen that there is every reason to suppose that succinite was reaching Italy during the Bronze Age. Whether it came into that country by way of the Western as well as the Central Route we cannot say for certain.

2. *Iron Ages.*

As far as Western Germany was concerned the amber trade continued uninterrupted during the Hallstatt Period, but the following La Tène Epoch witnessed somewhat of a decline.

The numerous amber ornaments found in the Early Iron Age cemeteries of Southern Switzerland seem to have come either from the Northern Apennine or the Sicilian deposits. In view of the evidence of Theophrastus (who speaks of amber being mined in the regions occupied by the Ligurians—a far larger area than that covered by the province which bears their name to-day), together with the complete silence preserved by the ancients as to the very existence of the Sicilian deposits, the former seems to be the more probable of these two sources. Moreover, the occurrence of amber antiquities in Sicily is uncommon both on the Iron Age sites, as well as on those of the Bronze Age. But in spite of this rarity, chemistry has shown that already in the Early Bronze as well as in the Early Iron Ages, *Northern* amber was being imported into Sicily (*Zeitschr. f. Ethnol.*, 1891, p. (291)). Beads, however, have also been analysed and definitely shown not to be succinite. But, as Lissauer (*ibid.*, 1903, p. 1028) observes, their identification with simetite has not been established. Although the natural ambers of the Lower Rhône region are still to be analysed, classical and other evidence would show that it is not inconceivable that Switzerland and the adjoining portions of North-Western Italy may have drawn part of their supplies from that quarter during the Early Iron Ages.

IV. The Eastern Routes.

1. *Stone and Bronze Ages.*

There remains but the Eastern Route to be discussed. During the Late Stone Age the amber from the East Baltic deposits played an important part in commerce. It was exported both to Russia and to Central Europe. Towards the end of this epoch, a great migration of peoples took place in the Lower Vistula area. It extended in a south-easterly direction through East Galicia as far as Southern Russia. This

exodus stripped West Prussia of the greater part of her population.* Here and there, notably in the southern districts, we find evidences of inhabitation, but during the greater part of the Bronze Age West Prussia was very sparsely populated. It may have been due to this that the East Baltic amber trade practically ceased at the end of the Stone Age. Map I. shows how rare is the occurrence of Bronze Age amber antiquities in the regions north of Silesia. The last-named province, where our mineral is better represented, seems to have drawn its supplies from Jutland by way of Bohemia, not from the East Baltic deposits. The occurrence of Italian imports found in East Germany, dating from the Bronze Age, is also extremely rare.

The Late Bronze Age witnessed the repopulation of West Prussia from the West.† But the amber trade did not begin at once, the region between the Lower Vistula and the Middle Danube being destitute of amber antiquities during that period. The opening of a transcontinental traffic in this mineral cannot therefore have taken place before the commencement of the Iron Age in what was Eastern Germany.

2. *Early Iron Ages.*

There has been a great deal of controversy as to when the East Baltic deposits first yielded their produce to the South. But it does not seem to have occurred to any one that the solution of the problem lies in the amber finds themselves. To-night we shall take their distribution into account and also the date that they first appear in the various intermediary regions. I have only time to summarize the evidence; to deal with the subject at the length it deserves would in itself form a very interesting paper.

Looking at Map II. you will see a succession of amber finds marked in red and extending from the Danzig region to the head of the Adriatic. These all date from the Hallstatt Period. I only propose following the main route. The main route, then, would appear to have passed up the Vistula until, somewhere in the neighbourhood of the first big bend in that river, it turned south-west and crossed the Netze near Nakel; threading its way between the lakes that lie between that river and the Warthe, it struck the latter stream probably near Obornik. South-west of Obornik lies the Early Iron Age cemetery of Gorszewice, where large quantities of amber occur, associated with such antiquities as the harp fibula (*Zeitschr. f. Ethnol.*, 1913, p. 783), a type which made its way north from the Austrian region. The route itself appears to have passed up the Warthe until reaching the Moschin region it struck across South Posen through Zaborowo (another Early Iron Age site where amber occurs in large quantities), possibly reaching the Oder near Glogau. It probably passed up this stream as far as Breslau, where it

* La Baume, 'Vorgesch. v. Westpreussen,' pp. 23 f.

† *Ibid.*, p. 32.

turned south, eventually crossing the Glatz Pass. This is one of the principal passes over the Sudeten, and it was used in very early times; a trade route running through this defile linked up Silesia with Moravia and Northern Hungary.*

At this point our route seems to have bifurcated, the western branch passing along the picturesque valley of the Zwittawa towards Brno. Somewhat to the north of Brno lies the celebrated cave of Byčiskala, where, with bronzes of Italian provenance and many other antiquities, over a thousand beads of amber were found.† This branch continued South till it reached the river March. The eastern branch, after leaving the Glatz Pass, seems to have reached the upper waters of March and made its way downstream until it rejoined the western branch near Hohenau. Amber has been unearthed at six different sites along the eastern branch. After the junction of the two branches, our route probably continued down the March to where its waters join those of the Danube. Traces of what appears to be an important Hallstatt settlement are to be found on the Braunsberg, a hill on the south bank of the Danube overlooking the confluence of the two rivers. Though it is yet to be excavated, I visited the site this spring and filled my pockets with sherds which had been cast up in the mole-heaps. It was on the right bank of the Danube, somewhat west of the confluence of these two rivers, that Carnuntum stood, the town which is mentioned by Pliny as having a connection with the amber trade. I have visited the local museum, which contains several amber finds from this district; unfortunately they were not discovered with any other antiquities, and so we cannot say if they were pre-Roman or not.

Some 50 miles west of the site of Carnuntum lies Gemeinlebarn, where amber was discovered with objects of a Hallstatt character.‡ Further to the west lies Statzendorf. Here antiquities of this substance were found in four different graves, all dating from phase C, in one of them associated with a harp fibula. §

South of Vienna amber was found in a tumulus near Fischau (Kr. Wiener Neustadt), also dating from phase C. ‖ As there was no important route over the Semmering in prehistoric times, it seems probable that amber found its way into Lower Styria and Carniola, etc., by more or less the same direction as that taken by the Roman road in later times, which passed from Petronell–Deutsch Altenburg (Carnuntum) through Sopron (Scarabantia), Szombathély (Sabaria), Pettau (Petavonium), and Cilli (Celeia). ¶ Therefore the amber from the tumuli near Wies **

* Seger, 'Grafschaft Glatz in Vorgesch Zeit,' pp 4 f.

† Own notes at Naturhistorisches Museum, Vienna.

‡ *Mitt. prähist. Kommission*, 1, 2, 1890.

§ *Zeitschr. f. Ethnol.*, 1913, p. 784; and oral communication by Dr. Mahr.

‖ *Mitt. d. Anthrop. Gesell. Wien*, 1924, p. 178.

¶ Miller, 'Itineraria Romana,' pp. 453 ff., figs. 120, 130, 134.

** *Mitt. d. Anthrop. Gesell. Wien*, 1885, pp. 117 ff. and notes in Vienna and Graz.

(which date mostly from the Later Hallstatt Period) came into Styria from the East and not directly from the North. It may be objected, judging from the map at the end of this paper, that no amber has been found along the above-mentioned route between Carnuntum and Celeia, but the writer has not yet had an opportunity of visiting the local museums in Western Hungary and Burgenland. Furthermore, apart from a few sites such as the Burgstall at Sopron (Oedenburg) * this region has not as yet been systematically explored. From the finds that have come to light along this line we have good reason to infer that a route of considerable importance ran through that region in prehistoric times. From Cilli this route entered Carniola. During the whole prehistoric period no region appears to have been richer in amber antiquities than Carniola. In a single tumulus near Sankt Marein ten thousand beads were discovered. Amber is also found in graves of the La Tène Period, but in these it is not so well represented.† At no great distance from the boundary of Styria and Carniola lies Waatsch, one of the most important Early Iron Age burial-grounds in the old Austrian Empire, and its graves yielded an extraordinarily large number of amber antiquities.‡ Somewhere in the region of Waatsch the ways parted not to rejoin. Time only permits my mentioning two of the several directions into which at this point the Eastern route ramified. A south-eastern branch passed down the Sava (Sau) basin, and fed the great Hallstatt and La Tène cemeteries of Bosnia with their by no means inconsiderable amber supplies, while another cut across country in a south-westerly direction until it reached the coast near Trieste.

With the exception of Este, which lies no great distance from the southern boundary of the province, I have not yet been able to locate any pre-Roman amber finds in Venezia. This is probably due to the marshy character of the Venetian lowlands, and to the many rivers that would have to be crossed by any trader entering the province from the East and making his way West and South. In view of this, I suggest that East Baltic amber, on arriving in the region of Trieste, was shipped across the Adriatic to Italy. In this connection it should be noted that the eastern districts of that country, more particularly Picenum, are extraordinarily rich in amber finds. Having seen how this route found its way southward, the next question is, when was it first opened ?

No amber has hitherto been found in the Early Hallstatt cemeteries of Lower Austria. The earliest finds are those of Statzendorf, Gemeinlebarn and Fischau, all of which date from the third or C phase of that

* Since writing the above, I have seen beads and fragments of amber in the Wolff Sammlung at Eisenstadt which had been found in the tumuli on the Oedenburger Burgstall (Hallstatt C).

† 'Wiener. Prähist. Ztschr.,' 1915, p. 102.

‡ In this connection it should be noted that *Ad Publicanos*, one of the stations on the above-mentioned Roman road, lies in the immediate neighbourhood of Waatsch (Miller, *l.c.*, p. 455).

epoch. According to the latest chronology, phase C dated from *circa* 700–600 B.C. This strikingly corresponds with the date given by the celebrated Silesian archæologist Hans Seger for the opening of the Iron Age in his province, viz. at the beginning of the seventh century, and it is with the opening of that epoch that amber reappeared there; during the Silesian Middle and Late Bronze Ages it rarely occurred. In Moravia, the region between Silesia and Lower Austria, it first appears in appreciable quantities in association with objects of the Platenicer culture, which is contemporary with Hallstatt C in Lower Austria.* Furthermore, I am assured by the authorities in Vienna that amber first became popular in Carniola during the seventh century, large quantities being already found by *circa* 650 B.C.

In view of this array of evidence there is little reason for doubting that East Baltic amber first reached the markets of Italy during the seventh century of the pre-Christian era.

Although the fourth century witnessed a very marked decrease in the amber trade with Italy, this mineral continued to be imported into Bosnia at all events down to Roman times.

V. Conclusion.

During the Stone and Copper Ages northern amber was finding its way as far South into Central Europe as Bohemia, where its appearance is sporadic. Some time during the opening phase of the Bohemian Bronze Age (in the Earlier Aunjetitz graves) its occurrence began to be more frequent. Furthermore, amber beads were discovered in two Early Bronze Age graves at Straubing, in Lower Bavaria. In the Later Aunjetitz burials antiquities of this substance are found very frequently indeed. Schránil (*l.c.*, p. 103) considers that the Early Aunjetitz phase began *circa* 1700 B.C. and lasted until *circa* 1500; the second phase he puts at 1500–1200 B.C. These dates are regarded as too late.† Seger holds that the Aunjetitz Period proper began *circa* 2000 and lasted until *circa* 1500 B.C.‡ As the Straubing finds can hardly be later than 1800 B.C.,§ it would seem that, as far as Central Europe is concerned, the first big development in the amber trade along the Central Route synchronized with the beginning of the Bronze Age in the North, which according to Montelius opened *circa* 1800 B.C., or perhaps even earlier. ‖ This synchronism adds new weight to the old view that it was owing to the opening of the trans-continental amber trade that bronze was first introduced into the North.

According to Schumacher,¶ the Middle Bronze Age (Tumulus

* 'Reallexikon d. Vorgesch.,' **2**, p. 94.

† *Ibid.*, **1**, p. 270. ‡ *Ibid*

§ The Straubing graves date from the Early Bronze Age (Behrens, *l.c.*, p. 65 f), and are therefore earlier than the tumulus period.

‖ *Congrès-Internat. d'Anthropol.*, 1906, Monaco, **2**, p. 274.

¶ 'Siedlungs- und Kulturgesch. d. Rheinland,' p. 61.

Period I.) in South-Western Germany began somewhere about the same time (*circa* 1800–1600 B.C.); and as amber is met with in these early tumuli, it would seem that the trade in this substance, which began to assume a greater importance (along the Central System) at the turn of the nineteenth and eighteenth centuries, underwent a still further development during the eighteenth or seventeenth century in the opening of the Western Route.

During the Middle Bronze Age, Southern and Western Germany seem to have played a larger part in the amber trade than Italy. Too much stress, perhaps, should not be laid on this point, for though the amber finds of the former regions far outnumber those of the latter, it was through Italy, in my opinion, that the Ægean world was supplied with succinite. There is not, at present, sufficient evidence for warranting an assumption that Northern amber was reaching Crete and Greece during the Bronze Age by way of Russia.

During the Bronze Age the amber trade with Italy, though important, was not so intense as that with Central Europe. Nor was the Italian influence upon the North so strongly felt as in the succeeding epoch. This may have been due to that influence taking some time to filter through the intermediary area. During the first of the Early Iron Ages a lively amber traffic was still maintained with Central Europe, while with Italy this commerce was greatly intensified. Trade relations from *circa* 700 B.C. became more highly organized: the above-mentioned filtering process seems to have taken less time; and the Italian influence upon Northern Europe was consequently more direct.

Reutter's experiments (see *supra*, p. 495) show that Italian amber deposits were known and exploited during the Early Iron Ages. Unfortunately, he has not analysed amber *antiquities* from Italy, but only some of those found in Switzerland and the North. He has made it clear, however, that Southern amber was imported into Switzerland during the Hallstatt and La Tène Periods. Although Reutter's actual percentages for the succinic acid contents differ from those of all other analysts, the proportion between his figures and those of the other chemists is more or less the same.* Bearing this in mind, it is of considerable importance to note that three-quarters of the specimens of Early Iron Age amber, found in Italy and subjected to chemical analysis, contain a sufficient percentage of succinic acid to warrant our assuming them to be of Northern origin.† Why, then, did the inhabitants of Italy import amber from so great a distance when their own supplies

* The difference is probably due to Reutter taking as his basis the percentage found in the precipitate obtained before treatment with ether, while the others take as their basis the percentage found in the totality of the bead. I am in correspondence with Dr. Reutter on this matter.

† From figures given in Meyer, 'Gurina,' pp. 80 f., and *Zeitschr. f. Ethnol.*, 1901, p. 400. The chemical aspect of the problem is fully dealt with in a book I am writing on the Amber Trade.

lay close at hand? Possibly the following hypothesis might account for this curious phenomenon: Otto Helm, one of the greatest authorities on the amber question, observed that the fossil resins of Upper Italy were apt to be inferior in appearance to succinite, nor were they as easily workable (*Zeitschr. f. Ethnol.*, 1901, p. 403). The local produce was good enough for exportation to the barbaric inhabitants of Switzerland, but the shrewd, civilized southerner kept the finer northern material for himself.

Although amber does not appear in appreciable quantities in the districts round the head of the Adriatic, at all events prior to the seventh century (*supra*, p. 491), it frequently occurs in burials of the Second Benacci Period in the Bologna region. As the Eastern Route had not then opened, it must have reached the latter area by way of the Central System. West of the Apennines amber of this date is not common. In view of Karo's important contribution on the chronology of the Orientalizing Period in Italy,* I am inclined to regard the amber trade as having first reached its zenith about the middle of the seventh century. The sudden increase of amber antiquities about this time in burials west of that mountain chain, may have been due in part to the opening of the Eastern Route, Italy being then supplied from the East Baltic as well as the Jutland deposits. The Eastern Route gradually tended to supersede the Central System, as far as the Italian markets were concerned. But as Italy became imbued with the influence of Greek classical culture, amber went out of fashion (see *supra*, p. 482). This had a far-reaching effect on the trade, and from the fourth century B.C., if not earlier, it became less and less important. The trade with Central Europe lingered on, but it was not as lively an intercourse as during the Hallstatt Period. The traffic along the Eastern Route with Bosnia and Croatia seems to have continued more or less undisturbed down to the Roman Imperial Epoch. But the cessation of the amber trade with Italy along the Central systems of routes is, in my opinion, to be numbered among the causes which contributed to the downfall of the great prehistoric civilizations of Sweden, Denmark, and the adjoining districts of Germany.

Before concluding, I should like to express my gratitude to my friend Doctor Mahr, of Vienna, for all I have learnt from him of the general archæology of the old Austro-Hungarian region. My thanks are also due to Doctor Seger for helping me to collect representative statistics for Silesia. I should here add that while I regard amber as having reached that province from Jutland through Bohemia, Doctor Seger holds that it came into Bohemia having first passed through Silesia.

* *Mitt. d. deutsch. Arch. Instit.* (Athens), **45**, pp. 106 ff.

NOTE ON CHRONOLOGY AND CHRONOLOGICAL TERMS

The following chronological table may be of assistance to readers who are not archæologists :

Stone Age.
Early or Palæolithic Epoch.
Late or Neolithic Epoch.
Copper Age.
Bronze Age. In the North the Bronze Age began later and lasted longer.
Early Bronze Age, c. 2000–1800 B.C.
Middle Bronze Age, c. 1800–1200 B.C.
Late Bronze Age, c. 1200–1000 B.C.
Early Iron Ages. In the North the Early Iron Ages began later and lasted longer.
Hallstatt Period, c. 1000–500 B.C.
La Tène Period, c. 500–1 B.C.

The Hallstatt and La Tène Periods are named after sites (in Upper Austria and Switzerland respectively) where, about the middle of last century, objects characteristic of those two civilizations came to light in very large numbers.

In the above table I have given only the roughest dates. We are dealing with a large area, and, as is only to be expected, the different periods began later in some regions than in others. Take, for instance, Map II. The amber finds in the western half of Northern Germany (using the Lower Oder as the dividing line) are very rare. One should remember, however, that there was a considerable chronological overlap between the Hallstatt Period in Central Europe and the Late Bronze Age in the North * ; and that most of the finds in the western half of Northern Germany, marked as Late Bronze Age on Map I., are in reality contemporary with the Hallstatt civilization in regions further to the South.† The chronological overlap is still more noticeable in the case of East Prussia, where the Later Bronze Age, according to Bezzenberger and Hollack, hardly began before 600 B.C.‡ The chronology of the prehistoric period in that province is badly in need of being established on a more modern basis. My amber statistics for East Prussia are not as representative as I could wish, much of the literature having been inaccessible to me. Amber, however, is frequently found in tumulus burials of the Later Bronze Age. Iron is not unknown in these graves.

Before the paper the PRESIDENT said : Our lecturer this evening, though he still possesses the priceless asset of comparative youth, has already acquired a fine military and academic record. Mr. de Navarro's studies at Cambridge were interrupted by the outbreak of war, and he lost no time in joining up and serving with the British forces. Invalided for a time as a result of the rigours of war, he later joined the American forces. On his return from military service he took up the subject which he has now made peculiarly his own, and some eighteen months or so ago, as a result of his success in his studies, he was elected a Fellow of Trinity College, Cambridge. He is to conduct us to-night far back in time to the days before history had thrown any light upon the geography of Central Europe. Where history fails us archæology

* By North I mean Sweden, Denmark, and the adjacent districts of Northern Germany.

† In West Prussia, Further Pomerania, Posen, and Silesia, where the Early Iron Age is more clearly defined, the Hallstatt amber finds are marked on Map II.

‡ Hollack, 'Erlauterungen z. vorgesch. Karte v. Ostpreussen.,' p. xxxvi.

steps in, and by means of the ancient finds, particularly of articles of amber, Mr. de Navarro is going to trace those great early trade routes which, apparently, traversed the Continent from Northern Germany to Italy. His paper will show that he has devoted great care and immense industry to the investigation of this subject, and I am sure you will be much interested in the peeps he will give us into pre-historic geography. I have much pleasure in calling upon Mr. de Navarro to give us his paper.

Mr. de Navarro then read the paper printed above, and a discussion followed.

Sir MARTIN CONWAY: I have nothing to contribute to the discussion either in the form of additional remarks or criticism of the learned paper to which we have listened, but our friend who has addressed us possesses by his parentage the right to the respect and, I may say, the affection of all those of my generation. I am glad, therefore, to take this chance of congratulating him. It is a great joy to me to hear his lecture; so learned; the result of so much research; so much bringing together of numbers of minute observations and drawing from them conclusions of wide and general interest. He has indicated to us, in a way that opens the door—in my case, at any rate—to future study, the variety of routes and sub-routes by which trade in amber and in other objects was carried on between the North of Europe and the Mediterranean regions in pre-historic times.

There is, I think, another route to which Mr. de Navarro had not time to refer, which went from the Baltic to the Black Sea, and along which amber was carried. Whether the amber which we find in the Ægean regions at a very early date came by way of that eastern route, or by way of Italy, or from some other source, Mr. de Navarro will perhaps some day be able to tell us. Amber is not a thing which exists in one place only, or in very few. It has been found, I believe, in the London Clay; though there is little doubt that none of that English amber, which must have been exceptional stuff, was ever worked in pre-historic times. I will not detain the meeting further, but I am glad to be able to congratulate the reader of the paper on the learning, industry, and clarity with which he has set forth his observations.

Prof. J. L. MYRES: I suppose we have seldom had a paper which has illustrated so emphatically the difficulty of drawing the line between what is geographical and what is not, and at the same time the significance of the geographical distribution of objects of very different kinds. As you have seen, Mr. de Navarro has in the first instance collected other students' plottings of the geographical distribution of various kinds of objects of human workmanship. Then, by comparing those distributions, he has, I think, arrived at a very near approximation to the reason why those objects came to be found in their particular positions. One has to remember—and I think that is what makes it possible to carry through what to those unfamiliar with it must seem the very dry task of collecting from little museums in the remote corners of Europe and from periodical literature still more remote, the data for a piece of work of this kind—one has to remember that every one of those plottings represents the spot of a particular object, which found its resting-place, either by accident, like that "terramare dagger" which represents some little tragedy on the pass over the Mühltal tunnel, or by design, as where any bit of treasured amber has been put—because they could not do otherwise—by the survivors in the grave of this or that person. In each such piece of evidence we are verifying somebody's attempt to satisfy some human need, either of himself or somebody else; we are dealing with clues to events which were really going on. And

that is why I think we have to be so especially grateful to our lecturer to-night that he has, so to speak, wound up the clock, again made the long-standing machinery go round, and shown us what was really happening over the Mühltal tunnel and in all those various bazaar towns, because one has to remember that though a great deal of amber went elsewhere through them, they were themselves dealing in amber and after all had first pick. A good many of the striking amber objects clustering as they do round the junctions of rivers, round such a bazaar-town, or the entrance to a pass, represent the place where a certain toll was taken of the trade by the people engaged in forwarding the goods: the labourer, then as now, was worthy of his hire!

Mr. de Navarro did not mention one striking ancient observation which, I have always felt, gives us another picturesque glimpse of trade in a material so precious, and at the same time so fragile in transit, as amber is. You will remember, perhaps, when Herodotus is trying to put together the little that he knows about far North Europe he tells (in Book IV. 33) the story of the people who lived "beyond where the north wind comes from," and how from that barbarian country there came at stated intervals across Europe a little caravan of persons carrying "sacred objects packed in wheat straw," and they came from tribe to tribe down to the head of the Adriatic, through the Venetian country, and again from tribe to tribe down to Dodona, where they first came into the hands of Greek traders, and from thence from city to city across Greece to the bazaar at Delos in the heart of the Ægean. Then, unfortunately, Herodotus' enthusiasm for folklore leads him to tell us an interesting story about the uses of wheat straw in the sacrifices of the Scythian women, and he entirely omits to say what was this precious thing that came from the ends of the Earth, so valuable that it was worth bringing to Delos, so fragile that it could only be carried in wheat-straw packages: and Herodotus was not allowed a peep at it. I greatly appreciate all the work Mr. de Navarro has done, and the way he has been able to pack so much amber-lore inside the wheat-straw package of a short hour.

Mr. GORDON CHILDE: It has been a great privilege to hear the paper delivered by Mr. de Navarro to-night. Listening to it you will not have been able to judge what an immense amount of work there is packed therein, with such consummate skill has he hidden his erudition and made its points readable and intelligible; but anybody who has had, as I have unfortunately, to study the complicated literature in which the archæology of Central Europe is enshrined will know what an immense task Mr. de Navarro has had to accomplish, and will appreciate how admirably he has mastered the material in order to be able to reduce it to such an extraordinarily lucid and artistic form. Naturally I can add nothing to the very comprehensive exposition which he has given, but it might perhaps be interesting to elaborate certain points.

Where did this amber go to in the early Bronze Age? Mr. de Navarro did not show us much in North Italy. The answer is, plainly, that it went to Greece and Crete. And I think there is no doubt that such trade was the life-blood whereby the great civilization of Minoan Crete and Mycenean Greece was pulsed throughout the veins of our continent to the young peoples growing up in the north. There is a very striking piece of evidence of that to which Mr. de Navarro did not call attention. Near Halberstadt, which would be on the western branch of his Central route, in all probability in an Aunjetitz grave, a very curious clay cup has come to light with a handle obviously imitating a metal handle; in fact, the cup is evidently a local imitation in clay of a very characteristic Minoan type of gold and silver vessel which we call the Vapheio

cup. That type of cup was in use in the last phase of the third Middle Minoan Period, and attained its maximum popularity in the first phase of the Late Minoan Period. The presence of this imitation of a Minoan object in Central Europe enables us to infer the presence also of the original in Central Europe, and so to infer that Minoan influence was reaching Thuringia at least in the sixteenth century B.C. I discussed the point with Sir Arthur Evans, and he agreed with me on that. So here is very striking confirmation of the chronology which Mr. de Navarro has been putting forward.

There is, perhaps, an additional point which may be adduced to give us a limit above 1600. It seems fairly certain that in the Aunjetitz civilization of Bohemia you may see the influence of Troy, which was a very important centre of civilization before Crete became all-important. In my opinion the tin which was used in the North Ægean came to Troy from Bohemia. That trade from Bohemia to the north of Asia Minor presumably went down the Danube valley; there are a certain number of Trojan daggers in that direction which seem to prove it. But, as far as I can judge, no amber ever went along that route. That is a very striking fact, and the only explanation of it is that Troy had fallen and the traffic along that route ceased before the amber trade between Bohemia and Denmark commenced. There are indeed in the Aunjetitz period itself survivals of this Trojan influence, but they are only urvivals. The connections with Troy therefore belong to an epoch before the Aunjetitz period; before the amber traffic began between Bohemia and Denmark. If Troy fell about 1800 B.C., that would give us a date somewhat higher than Dr. Schránil's date and something lower than Dr. Seger's for the earliest Aunjetitz graves.

Lest it might be thought that such points of chronology are irrelevant to the aims of this Society, I would like to remind you that in recent work on the alterations of the climate in Europe in post-glacial times a great deal of stress has been laid on efforts to determine the date at which the Alpine passes were first used by travellers and traders. It is inferred that there was no traffic across those passes before the Copper Age, because the Swiss glaciers were still, even in the post-glacial epoch, extending down considerably lower than they do now. That is the inference of Gams and Nordhagen ('Postglaziale Klima-änderungen').

There is just one criticism I would like to make. That is that Mr. de Navarro accepts the view of Kossinna's school, that East Prussia and various areas were suddenly emptied of their populations. This is a rather important matter for geographers. The German authors base their inference upon the fact that one does not find just in those regions a certain set of objects taken as typical for the period in question. But supposing European civilization stopped at this moment—was wiped out—and that two thousand years later some people came along and started to excavate: they would take as the types of the twentieth century civilization maxim-guns, Ford motor-cars, and wireless sets. They will go into Albania and will not find maxim-guns, Ford cars, or a perceptible percentage of wireless sets, and will therefore infer that there was nobody in Albania! It was just the same in pre-historic times. There were then too people in regions lying off the main lines of commerce, and consequently backwaters of civilization, who continued to use stone while other people were using bronze, and, as the lecturer admits, there were again those who used bronze while others were using iron. These supposed gaps then are really quite illusory. There were people in the regions in question, but they were in the Stone Age, the Stone Age in such instances corresponding

to the Bronze Age in other parts. It is rather important for the geographical interpretation of pre-history to beware of the extravagant views of the school of Kossinna. I can only thank the lecturer very much for his wonderfully illuminating paper.

Mr. DE NAVARRO: Unfortunately, the amber trade with Greece and the East Mediterranean area falls out of the scope of the present paper. The Baltic–Black Sea route is, in my opinion, a late development. The vessel alluded to by Mr. Childe was already known to me: it is one of the factors used by Seger in determining the lower limit of the Aunjetitz Period (see 'Reallexikon d. Vorgesch,' 1, p. 270, pl. 53, fig. a). If I am right in following the views of Kossinna and his school, the depopulation of North-East Germany would no doubt account for the East Baltic amber trade falling into abeyance. If Mr. Childe is right, he must still admit it inconceivable that so backward a region should be exporting amber on so large a scale to the south. Whichever, therefore, of the two views proves to be the correct one, my contention for the interruption of the East Baltic amber trade would still appear to hold good.

The PRESIDENT: I should like, before you leave, to convey to Mr. de Nararro a sense of the gratitude of this audience for the capable and painstaking research of which the paper he has given us to-night is so striking a proof. Mr. de Navarro has, we hope, many years of activity before him, and considerable though his contributions to this interesting subject already are, we look forward with confidence to his making even greater contributions towards it in the future. He is shortly about to embark upon a programme of excavation in Central Europe, and I can assure him that after the interest which he has aroused in us this evening we shall look forward with great interest to the results of his future labours. We offer him our very best wishes for success in this particular branch of study which he has made so peculiarly his own.

LALIBALA

Rosita McGrath

THE rock churches of Lalibala have been visited by few Western travellers, yet they rank, undoubtedly, among the wonders of the world, and the legends of their miraculous construction, and of the cures wrought by the little stream of Jordan which waters them, have made them throughout the ages a Mecca for African Christians. Father Alvarez, the Jesuit priest who accompanied Don Rodrigo da Lima's Portuguese mission to Abyssinia in 1520, was probably the first European to see Lalibala, and, after a meticulous description, he seems to realize how likely it was that the mediæval world would regard his tale as fabulous, for he adds: "It wearies me to write more of these works, because it seems to me that they will not believe me if I write more, and because as to what I have already written they may accuse me of untruth; therefore I swear by God, in whose power I am, that all that is written is the truth, and there is much more than what I have written and I have left it that they may not tax me with falsehood."

Castanhosa, the chronicler of Don Christofero da Gama's expedition,

which left Massawa in 1541 to assist the Negus in his crusade against the Moslem invaders led by the Emir of Harar, Imam Admed el Gran, describes his arrival at "a hill, on whose top were twelve monasteries of friars, or churches in which religious men lived." He is a careless writer and it is difficult to follow the course of his journey, since the few names he mentions do not exist to-day, but if his text, as is possible, means that he covered in eight days the 110 miles from Lake Tana to Lalibala, the army averaged a daily march of 14 miles through difficult and in some places almost impassable mountain country. After describing a visit to the tomb of the king (Lalibala) "from which every man took away earth as a relic," he insists, like Alvarez doubtful of his story's reception, that everything he says of the strange rock churches is the truth!

"The friars have many writings," adds Castanhosa. "These they showed us. They were in Chaldean, all on parchment, and even had we known the language they could hardly have been read, so worn and old were they. I heard them say that the King of Zeila came to see these edifices and that two Moors tried to ride in, but when they reached the door their horses burst." *

An Arab chronicle exists (translated by Basset) which gives the following account of the Moslems' arrival at Lalibala:

"Ahmed afterwards made preparations to advance into Tigre. . . . Then he learned that the idolators had assembled near the church called Lalibala. He marched against them across mountains and by a very difficult road during continuous rain; his men died of cold. They reached the church, where the monks were collected to die in its defence. The Imam examined the church and found that he had never seen the like. It was cut from the rock, as were the columns that supported it. There was not a piece of wood in all the construction save the idols in their shrines. There was also a cistern hewn out of the rock. The Imam called together the monks and ordered them to collect and bring wood. They lighted a fire, and when the fire was hot, Ahmed said to them, 'Now let one of you and one of us enter,' wishing to see what they would do and to test them. Then their chief said, 'Willingly I will go in'; but a woman who had adopted the religious life arose and said, 'It is he who expounds to us the Gospel. Shall he die here before my eyes?' and threw herself into the fire. The Imam cried, 'Drag her out.' They dragged her out, but part of her face was burned. Then he burned their shrines, broke their stone idols, and took all the gold plates and silk textures he found."

For some three centuries after the Portuguese expeditions, Lalibala was forgotten by the West. Then the French Consul at Massawa,

* It is probable that a Franciscan, Thomas de Ganget, visited Lalibala (calling it Uruuar) in 1522 or 1523, for he writes: "At Uruuar are 12 churches, some monks, and the tomb of the Holy King, Lalireca, which performs miracles. This spot is an important place of pilgrimage."

THE MOUNTAIN ON WHICH STANDS LALIBALA

Rock churches are beyond main ridge under tabular summit

ENTRANCE TO GABRIEL CHURCH IN OUTER ROCK BLUFF OF LALIBALA

AN OUTER TRENCH USED AS PASSAGE BETWEEN SUNKEN COURTS; ENTRANCE TO ROCK CHAMBER HALF CLOSED WITH BRICK

MADANE ALAM FROM ABOVE

SOUTHERN FAÇADE OF LARGEST ROCK CHURCH, MADANE ALAM

EAST END OF CHURCH, MADANE ALAM

Achille Raffay, accompanied by Gabriel Simon, an ex-cavalry officer, penetrated the Lasta Mountains, and each left a record of the red city in books published in 1882 and 1885. The famous German explorer Rohlfs followed them, but after this there were no more occidental caravans till the French minister at Addis Ababa, Monsieur de Coppet, and his wife passed through Lalibala on their way to Eritrea in 1923, followed by an American, Mr Harlan, and later by Mr. Jones and myself.

The rock churches of Lalibala are generally attributed to a king of the same name who reigned, according to Salt, in the last half of the eleventh century; according to other authorities, at the end of the twelfth and beginning of the thirteenth centuries. Legend and the belief of priests and people accord them a date seven hundred years earlier. It is recorded that Lalibala * had an Arab wife, whom he married while on a pilgrimage to Jerusalem. On his return he brought with him several hundred Palestinian workmen, to whom he entrusted the construction of the rock churches, whose site had been revealed to him in a vision. The priests, however, possess manuscripts written in Geze and Arabic mixed, which, if accurate, would show that troglodyte dwellings of a much earlier date already existed at Lalibala.

In some accounts the six hundred workmen were Egyptian, not Arab, but all the local records agree that the labour of hewing the great monolith blocks out of the earth and the carving of windows, doors, arches, aisles, and columns from solid rock, was too colossal for human effort. So every night, while sculptors and masons slept, a legion of angels took up their tools and continued the work through the darkness. Consequently every morning the workmen found some mighty column added to a façade or some new court begun. For years the hosts of heaven and the strangers from Nile or Jordan worked in turn. Thus by sunlight and by starlight church after church grew to completion, each carved out of a single mass of stone, not below, but level with the surface of the ground.

Each court is a great oblong pit some 40 feet deep. In the centre is the church, its bulk of line giving it a stateliness emphasized by the bold simplicity of carving and ornament. The ground immediately round the churches is enclosed by a cane fence, and the priests' huts creep right up to the edge of the sunken courts, which are sometimes joined one to the other by low tunnels, through which a man cannot walk upright. The natural walls between two such quarries are 15 to 30 feet thick. Standing on the top of one, it is possible to get an impression of the labour expended on this labyrinth of excavated corridor and court, church, porch, and colonnade, and to compare the signs of different periods and schools of workmanship.

Achille Raffray, who had access to all the local records and could

* Lalibala, born at Roha, in Lasta, was a king of the Zagues, a usurping dynasty, about which little is known.

apparently translate them, attributes the construction of the Lalibala churches to the fifth century.

"The king who caused these churches to be built was the Negus Lalibela, the fifth Christian Negus and the third who reigned at Lalibela. The two first had reigned at Axum. Now, it was at the beginning of the fourth century that St. Frumentius had evangelized and christianized Abyssinia, and Lalibela was the fifth Christian Negus. Reigns at that epoch were probably long; legend and the manuscript say that a hundred years had passed for five sovereigns. Consequently this would put the erection of these monuments towards the beginning of the fifth century." *

Monsieur Raffray also states that the King employed four or five hundred European workmen, and one of the old Ethiopian manuscripts states that the work was accomplished by white men. Another Ethiopian manuscript gives the following description of the King's work:

"Lalibala passed three days and three nights in ecstasy. The angel of God revealed to him the secret of the heavens, 'According to the will of God,' said he. 'Go and build ten churches where sinners will find pardon.' He rose, reigned, and built as the angel of God had shown him. From one stone he made first the house of Mariam, then Debra Sina, with Golgotha on its right, the house of Meskal (the cross) on its left, the house of Madane Alam, the house of Dan Aghel (the virgins); the walls and columns are of stone. He built also the House of Gabriel, and later the House of Libanos. Their wall is one. He built also the house of Mercury and afterwards the house of Emmanuel and surrounded them with a wall. He built separately the house of George. He did nothing except in accordance with that which the Lord had shown him."

A manuscript still existing at Lalibala, which has one page, written in Greek, Arabic, and Geze, giving the churches, the town, and the surrounding territory to the monks in perpetuity, tells of the lineage and birth of Lalibala, who "reigned forty years. His nourishment was Zengada and three mouthfuls of Onet—he never had a fourth. At seven years of age he knew how to read without fault; ten years after his coronation he built eleven churches. He accomplished one trench by day and the angels made four for him by night. He arrived at the age of seventy years and finished his building in twenty-three years."

Yet another record runs:

"On 17th June, the blessed unspotted contemplator of the Heavenly mysteries, Lalibala, Emperor of Ethiopia, went to rest. When this saint was born, his parents educated him in the fear of God, and when he was grown up a youth, the Emperor his brother was told that he should possess his empire and sit upon his throne, whereupon he grew envious, sent for him and ordered him to be whipped; but the stripes did not touch him, the Angel of the Lord delivering him, which angel revealed

* Translated from Raffray's 'Voyage en Abyssine et au pays des Gallas-Raias.'

to him that he should build ten churches, and when he had done building them he should rest in peace."

It seems incredible that such a colossal work could have been accomplished in the twenty-three to twenty-eight years allowed by the Ethiopian chroniclers. The whole of the excavation must have been done by pick, though chisels have been used for the interiors and the ornamentation, and it would be interesting to know how the workmen disposed of the immense quantity of rock they hewed out of court, trench, and underground passages. Touma Lishan, chief priest of Debra Libanos, pointed out to me that "before history began," *i.e.* before the days of the Aksum kingdom in 1000 B.C., the Ethiopians were cave dwellers. Prehistoric caves exist at Ecca in the Bulga gorge and in the mountains between Lalibala and Gondar, where there are several cave churches, not always correctly oriented as are the great monolith blocks of Lalibala. According to Touma Lishan there was an ancient colony of cave dwellers at Lalibala, who enlarged the natural caverns where the salt-water pools had softened the rock and facilitated the work of excavation.

It is possible that some of the very primitive grotto churches belong to the earliest days of Christian Abyssinia, and, at first sight, one would imagine that the conception and construction of the huge monoliths, though not their decoration, date from an age when unlimited slave labour was at the disposal of autocracy. Against such theories are the facts that each church is properly oriented, which rule did not come into force until the sixth century, and at least three ancient Ethiopian manuscripts give a list of ten or eleven churches by name, whose construction they attribute to Lalibala.

Raffray's conclusions concerning the date of Lalibala's reign are less convincing, I think, than Salt's evidence, which fixes it as 1095. Yet, if the latter authority is correct and if Lalibala may really be credited with the construction of the eleven churches, it is extraordinary that there should be signs of apparently successive schools of art. Rohlfs traces a consecutive development from the earliest work, which would appear to be Byzantine, at least in influence. It was in the sixth century that the Arabs learned the art of Greece, and it is possible that their craftsmen, under the influence of the Neo-Greek, completed Lalibala after this date. The construction of the monoliths might well have taken two hundred years, given the conditions of slave labour, and the decorations may have been added throughout the centuries, till, as at the present day, we can see Moslem, Christian, and pagan symbols, remains of carvings, frescoes and statues, ranging from the original lion heads of the earliest dynasties, to mediæval, probably Portuguese bas reliefs.

The list of churches given by Alvarez and other Jesuit authorities is: Emanuel, St. Saviour, (Madane Alam) Mary, Holy Cross, (Meskal) St. George, Golgotha, the Martyrs, Marcos, Bethlehem, and "The

principal one is Lalibela ! " Simon and Raffray give the list as Emanuel, Saviour, Mary, Holy Cross, George, Golgotha and Michael, which are the same rock, the Virgins, Mercury, Libanos, and Gabriel. The priests of to-day confirm the latter list. I think Marcos and Mercury are alternate names for the same church, and, from its position, the Virgins and the Martyrs appear to be the same construction, but of a Lalibala, important enough to be called the principal church, I can find no trace. I heard the name applied by different priests to St. George, because of the legendary hoof-prints of the king's horse ; to Golgotha, where he is buried ; and to Libanos, which contains a rapidly fading fresco portrait of Lalibala with his wife, Meskal Kebra, who is said to have constructed or completed the church in his honour, and another almost obliterated figure.*

The churches can be divided into two groups. The first contains the Virgins, Mary, Madane Alam, Holy Cross, Golgotha, and Michael. The second contains Gabriel, Libanos, Marcos (or Mercury), and Emmanuel. St. George stands alone, a little lower down the hillside. It is perhaps the most interesting church, for it is in the form of a Maltese Cross, and its roof, level with the earth, is ornamented with a double cross.

In the trough by which we went down to the sanctuary are certain scars on the rock face which are supposed to be the hoof-prints of St. George's horse. Legend says that the Warrior Saint was wrathful at his omission from the list of patrons of the newly excavated Lalibala churches, so, mounting his fire-shod steed, he rode down from Heaven vowing vengeance, but was placated by the promise of a habitation more beautiful than any of the others. I must confess that I also heard the hoof-marks attributed to Lalibala's horse, as he rode round overseeing the work, which is more logical, since they are on the inside of an already cut trough !

The " House of George " is entered by way of an underground chamber which serves as a vestry for its priests. We went up a flight of steps, through a rock portal into a room hung with sacred pictures painted on white cotton stuff, and out again into a small quarry shaped like a cross. On one side, some 6 feet from the ground in a hollow in the wall, is a small carved tank full of water which is said to come from some hidden spring. It percolates very slowly, probably from some underground tributary of the Jordan, which, flowing round and under Lalibala, has in certain places worn away the rock, and perhaps, like the suppositional salt pools, facilitated the work of excavation. The water of this stream is supposed to cure most mortal ills, and baptism in it is as much coveted as in the real Jordan.

* Monsieur de Coppet speaks of Golgotha or Lalibala, and Mr. Harlan describes Golgotha under the name of Lalibala. Alvarez, however, particularly states that " the tomb of Lalibela is *not in the church* which bears his name, but in Golgotha."

The name has led to some confusion, for one writer, told that the pools of Mariam contained " Jordan water," attributed it to the Palestinian river.

The court round St. George is full of tombs, and I imagine that all the holes in the rock, half blocked with stones, which are seen all over Lalibala, are burial-places, for the city is regarded as holy and interment within its bournes a sure road to Paradise. Simon writes of dried corpses in the crypts which were wrapped in ox-hides or tied up in hollow tree-trunks.

The arched doorway leading into the church of George is beautifully carved, and the windows are among the most original in Lalibala, for they show the Greek cross and the Moslem crescent. The interior is some 40 feet in diameter.

The first group of churches is the most important, for it contains the colossal Madane Alam and Mariam, separated only by a great bastion which is pierced by one of the tunnels which look like rabbit-holes. The base of the first, which projects a few feet beyond its walls, is roughly 38 yards long and 27 broad, while the subterranean court in which it stands is 45 yards long and proportionately wide. The priests told us that there were originally seventy-two columns in and around this church, but many have been broken. There is still a colonnade of mighty blocks at the eastern and western façades, and a few remain at one end of the southern. Inside there is, first an antechamber like a broad passage, with a second door which opens on to the central of five aisles. These are divided by twelve pillars, massive and square, supporting round arches, some of which are decorated with a round carved plaque. There is no central tabernacle, as in most Abyssinian churches, but what would, in Europe, be the choir is walled off between the four additional columns of the side aisles, and a curtain hangs across the central space. The priests would hot allow this to be lifted as it veiled the high altar, but above it we could see the capitals of another quartette of pillars and the corresponding round arches which support the roof. This is carved on the outside in a manner which suggests groining, and the small irregular windows show Arab and Greek designs.

There are two lines of windows. The lower ones are square, with divisions in the form of a Maltese cross, except on the east front, where irregular openings are decorated with Arab arches above a Greek key-stone or cross pattern. The upper windows have a sort of rock lattice in places, cut into crosses, crescents, stars, and swastikas. The roof of Madane Alam is most curious, for it is slightly curved and has a series of arches carved in low relief upon its grey weather-beaten surface. It protrudes a little beyond the walls and is supported at the east and west fronts by eight pillars surmounted by a narrow pediment with semi-circular reliefs and a cross at each end. It is possible that originally this canopy effect was carried out all round the church, since Alvarez writes :

" Above this church, where it should be roofed, there are on each side nine large arches like cloisters, which descend from the top to the bottom."

I was not allowed to enter Mariam, the adjoining church, for nothing feminine, whether human or animal, may penetrate a sanctuary of the Virgin. It has three porches standing out from the main block, and it is much smaller, not only than its neighbour Madane Alam, but in proportion to the size of its court, which contains two sunk pools and a large stone which was variously described as part of a seat and as the beginning of what was intended to be a series of columns. The northern wall of the court is beautifully decorated with a design of round arches in low relief, and beyond it is a storehouse or enclosed cloister, originally designed as a church. Above the main door of Mariam is a low relief carving of a mounted St. George fighting the dragon, which, obviously of a later date than the church, Simon suggests is of Portuguese origin. I was told that Mariam has three naves, and that the pillars, without capitals, support round arches painted in geometrical designs in primal colours, above which is a roof with faded frescoes. One corner of the outer wall has been mended with mud bricks, as the result of an earthquake some hundred years ago.

Father Alvarez's description of Golgotha, the monolith church, whose terrace roof is on a level with the court of Mariam, is still correct in every detail, except that he speaks of the adjoining church of Michael as if it were a chapel, and I did not see the two statues which he describes. These may have been among the number destroyed by Ahmed el Gran, but as, at the time of our visit, the church was hung with sheets or clothes in mourning for a priest, so that we could not see the walls, they may still exist. Monsieur de Coppet describes Golgotha or Lalibala " where one is surprised to see 10 statues standing or lying." Mr. Harlan describes, in the church of Lalibala, statues carved in high relief on the walls, but not separated from them. There are ten of these figures, he says, chief among them being a young man afflicted by a horrible disease because he refused to marry at his father's command. The church of Golgotha is, according to Alvarez, " 120 spans in length and 72 spans in width. The ceiling rests on five supports, two on each side and one in the centre. The gallery which goes round the church is like a cloister and lower than the body of the church, and one goes down from the church to this gallery ; there are three windows on each side, and if one looks " (presumably from outside) " through each of these windows which is opposite the sun, one sees the tomb at the right of the high altar. In the centre of the body of the church is the sign of a door like a trap-door ; it is covered up with a large stone like an altar stone. They say that this is the entrance to the lower chamber, and that no one enters there, nor does it appear that that stone or door can be raised. This stone has a hole in the centre which pierces it through " (the hole is about 1 foot

across). "All the pilgrims put their hands into this stone and say that many miracles are done there."

There is a second tomb in this church, which is variously said to be a copy of the Holy Sepulchre at Jerusalem and the Tomb of Adam. The dark vaults and passages below this and other churches are known as "Hell," and it is said that only the faithful can lift the great stones which close them. The tomb of Lalibala was draped, when we were there, with a red and white cloth, as it was too sacred to be seen. Mr. Harlan speaks of a column being covered in the same way and for the same reason. Father Alvarez continues: "Two great images were carved into the wall itself, which remain in a manner separated from it. They showed me these things as though I should be amazed at seeing them. One of the images is St. Peter, the other St. John; they give them great reverence."

Besides the "House of Michael," almost square, with three aisles, there is a chapel shaped somewhat like a Gothic baptistry. The windows of both churches show the same Greek and Arab contrasts as in St. George. Some are simple crosses pierced in the rock, others are pointed or round arches decorated with scrolls and leaves. A few are divided in four by elaborately wrought Greek crosses.

The churches of the Virgins, which is barely 18 feet square, and of Holy Cross are grottoes hewn out under the rock. Their vaulted ceilings show traces of old colouring, and they were hung with white cloths bearing crude pictures of dark saints and angels.

On the farther side of Lalibala, the second group of churches consists of Emanuel, Marcoyos, Gabriel, and Libanos. These have all been hewn out of the same hill, and the first glimpse of them is a stupendous round bastion encircled by a trench 40 or 50 feet deep, with a corresponding outer wall. Down into this trough we clambered, and then through a hole which seemed to have been blasted or torn out from the 28-feet thick rampart, or perhaps it was worn into its present irregular ledges by the feet of countless worshippers. By this tunnel we mounted, twisting, into a court some 30 yards long, with the Church of Emanuel on a central pediment 19 yards by 13 yards. The interior is divided, as are the modern churches, into an outer corridor or aisle and a holy of holies between four square columns supporting round arches just below the roof, and another set of pillars is carved into the walls.

"The House of Marcoyos is underneath," explained a friendly priest; and, seizing my hand, he led me into the darkest corner and began fumbling on the ground. I suppose he pulled up a stone, for in a moment all but his head and shoulders had disappeared. "This is the way. Come and visit Marcoyos," he urged. But I hung back until a tallow taper was produced. Then gingerly we felt our way, step by irregular step, down some 12 feet perhaps, into a subterranean passage, the height of a tall man and wide enough for two to walk abreast.

The floor was rough, and the light was insufficient to see more than that the walls were smooth and bare of decoration. A crowd followed us into the confined space, and the echoes of their voices boomed as if we were shut into the inside of a drum. Once the taper went out, and the crush, smell, and curious throbbing echo in the blackness were sufficiently unpleasant to make me thankful when some one dragged me forward, apparently over various unprotected bodies.* Round a corner I was pulled, and up towards a gleam of light, which revealed numbers of bare legs. A moment more and I had stumbled to a level with their bodies. We were in the portico of Marcoyos, roughly hollowed out of the rock face. Here there is no court or carving, but just a few simple arches hewn out under the earth. Others divide the cave into two lateral aisles, so that this is a troglodyte church, penetrating 20 or 30 feet under the surface, its roof a few yards below it. Light comes through gaps in the front, where the spaces between the arches are filled with painted cloths, and in some places the overhanging earth is propped with mud bricks. It contains some frescoes of the Virgin and Child, St. George and St. Michael, but the original colours have faded and the outlines have been strengthened with charcoal and chalk. Beyond Marcoyos we climbed a rampart crowned with olives and long grass. From this we had a sudden exquisite view across one of the maze of trenches and a further flower-sprinkled wall. In a small pit or quarry, before the House of Gabriel, which is supposed to be a copy of the Temple at Jerusalem, a priest sat pounding grain as golden as the great vellum missal that lay beside him. One side of this primitive court is sheer red rock, hewn into a doorway, massive and stately. Its plinths and lintel are as solid as the steps which lead up to it, and their primæval simplicity seemed to me more in keeping with the mountains and the gnarled ancient olives than the complex carvings which pierce the equally sheer front of the neighbouring church, Libanos.

My impression is that, though the front of this church, which opens into a trough full of weeds and stones, is considerably damaged and reinforced in places (like several of the grotto churches) with mud bricks, the interior is one of the most elaborate in Lalibala. It is small, with a door so low and narrow that it ought to have belonged to a doll's house. The capitals of its square pillars show elliptical designs, and above them is a frieze in bold relief with pieces jutting out like miniature buttresses. There is a very discoloured fresco, now outlined with a burned stick, of King Lalibala, his wife, and an almost invisible figure, which the French authorities refer to as Abba Libanos, but which was pointed out to us as Sidi Meskal (My Master of the Cross), the Palestinian architect whom Lalibala is said to have employed in the construction of the churches. It seemed that the priests had very little knowledge concerning their

* The vaults are full of corpses wrapped in chammas and, I believe, preserved or dried in some manner.

TYPICAL ROCK COURT, PORCH, AND ARCHES IN LOW RELIEF
Northern Wall of Mariam to left: Southern of Golgotha to right

DOUBLE ENTRANCE TO UNDERGROUND CHURCH OF GOLGOTHA AND CRUCIFORM WINDOW

CHURCH OF MARIAM, REPAIRED AT CORNER WITH MUD BRICKS AFTER EARTHQUAKE

GONDAR: TWIN PALACES OF KING FASIL BUILT BY PORTUGUESE IN SEVENTEENTH CENTURY

GONDAR: PORTUGUESE BRIDGE

FAÇADE OF LIBANOS CHURCH, RECENTLY REPAIRED WITH MUD BRICKS

churches. Most of them were ignorant men who could not read the splendid old missals which they showed us, and which, though they contained several early Arabic paragraphs, were by no means in the illegible condition described by Castanhosa. If we asked the chief priest how many churches there were, he had to count them up on his fingers before answering, and he was never able to repeat their names without a mistake. There was much argument, too, as to whom the frescoes and bas-reliefs represented. I think that each year and each pilgrim season new legends are added to the wealth of fable concerning Lalibala. All the churches were in use when we saw them, and the storehouses or vestries in the rock were full of crudely painted cloths, crosses, hide drums, censers, and vestments. We were shown a number of small rock rooms, scarcely more than holes or shelves in the wall, in which no one could stand upright, where it is said the workmen lived while they laboured on the churches. The priests said there were three or four hundred of these cavities, but they did not much differ from the tomb shelves, except that the latter were generally partially bricked up. The population of Lalibala to-day must be about 7000, but it is a fluctuating one. At the great feasts of the Church's year, Easter, Epiphany, Christmas, several thousand pilgrims visit the red rock city, and at such times the dwellers in the mud huts above ground-level overflow into the maze of rock chambers and caves below. We saw no furniture in the underground places, except mats, hides, a few stools, pestles and mortar for pounding grain, and cloths painted with holy pictures. The sacred books I saw were kept in an underground room, and the priests apparently spend most of their days in the rock city, coming up to ground-level when they wish to visit their families in their thatched mud huts. Technically no one is supposed to enter an Abyssinian church unless he or she has been virgin for twenty-four hours, but the courts are general meeting-places for the population, which, like Debra Libanos, the Jerusalem of Abyssinia, is entirely religious. It consists of priests, deacons, monks, their families, pupils, and dependants, augmented by the pilgrim traffic and mourners who come to wail for their dead or to bury them in sacred ground.

The first four European expeditions to visit Lalibala, Portuguese and French, came from Massawa, which is certainly the easiest route. Now that the Italian Government in Eritrea sends its lorries as far south as Addi Quala, it should only be a two-days' mule ride from there to Aduwa, and a ten-days' trek south from that last Italian Consulate. Monsieur and Madame de Coppet approached Lalibala by a roundabout way from Addis Ababa, and continued by the direct route above mentioned to Asmara. Mr. Jones and I trekked from Diredawa *viâ* Ankober, Addis Ababa, Debra Libanos, Debra Markos, and Debra Tabor; but the direct southern route which would avoid several difficult mountain stretches would be from Addis Ababa across the plain to Ankober, and

from there north through Magdala and along the main caravan route to Eritrea which passes close to Lalibala. Anxious not to retrace our steps to Debra Tabor, Mr. Jones and I were guided by an old slave-trader direct from Lalibala to Gondar. There is no path between these places, but, by following river-beds in the valleys and using a compass in the mountains, with the aid of the huge cone of Zos, visible for several days in each direction, it is possible to accomplish the journey in eight to ten days' hard marching. We saw three troglodyte churches on the way, the best of which was Zos Gorgis under the summit of the mountain of the same name, and we were told of several others. All three were grotto churches, and in each case the cavern was hewn out of the same kind of red rock as at Lalibala. In fact, wherever there is a splash of red on a hillside, it is probable that there will be a cave dwelling or a church, and I have heard the natives refer to such underground places by the generic name of "red houses." *

Alvarez wrote of Lalibala "neither a jeweller in silver nor a worker in wax could do more work," but to me the chief impression, beyond the bulk of the monolith blocks, was the squareness of every detail. With the exception of the ground-level above bastions and tunnels, the arches, a few window and other carvings, and the almost imperceptible downward curve of the roof edges, everything is hewn with uncompromising angularity. If the line of beauty is a curve, Lalibala is not beautiful, for courts, pediments and churches, sunken water-tanks, windows and the geometrical designs within their frames, columns, capitals, and porches give an effect of square solidity. There is nothing to break what is to some extent an illusion, except the sweep of the outer trenches encircling the huge rock bluffs which contain the houses of God's saints. As soon as men or angels touched the stone, they wrought it into sharp corners and a sturdy definitiveness of line foreign to the earth out of whose breast they cut it, but in keeping with the tabular ridges, cones, and buttresses, result of volcanic upheaval in this land of ancient violence.

Above the round slope of Lalibala towers such a monument, chiselled by nature into rampart and altar, which may well have served as model for the equally bold fortress churches under its shadow.

[*Note by the Editor on the name Lalibala.*

Mrs. McGrath thinks that Lalibela is nearer the general pronunciation, but accepts the Lalibala of the P.C.G.N. for spelling. She is, however, certain that the stress is on the third syllable, and not on the second: and this is also the opinion of another recent traveller. The pronunciation Lalíbala given by the P.C.G.N. was on the authority of Mr. Armbruster and Major Alone. The conflict of testimony is therefore complete.]

* As my Somali interpreter died on the way and only one of the priests could speak a little Arabic, it was difficult to acquire exact information at Lalibala. A priest would have to speak in Amharic to a soldier, who would translate dubiously into Arabic for me.

NOTE ON A PORTION OF THE TSANGPO

Major F. M. Bailey, C.I.E.

IN returning from a short visit to Lhasa in the summer of 1924 with Major Hislop of the Indian Medical Service, I had an opportunity of using a little-known road and also of completing by a rough prismatic compass traverse the survey of about 50 miles of the Tsangpo between the point our surveyors were able to map during Sir Francis Younghusband's Mission in 1904, and Tsetang, the point up to which Major Morshead surveyed it in 1913.*

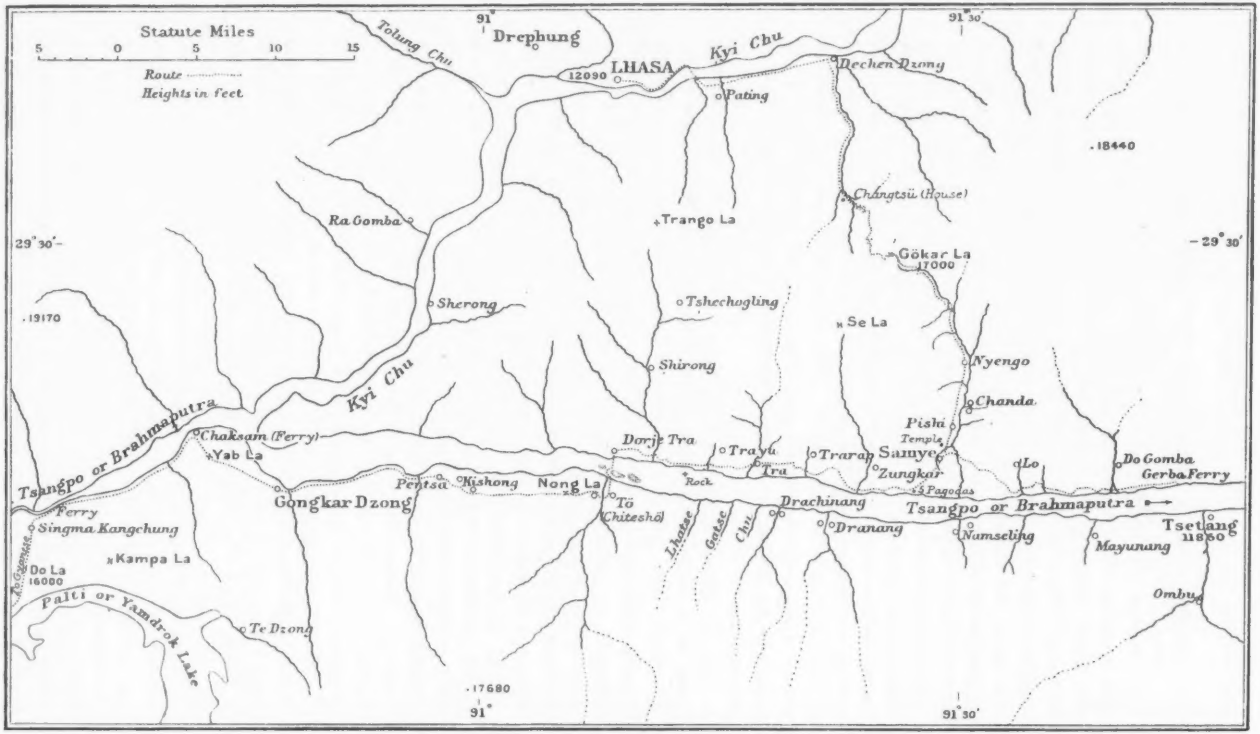
Leaving Lhasa on August 16, we travelled up the right bank of the Kyi Chu for some 4 miles, when the river was crossed to the left bank in skin coracles. The river was in heavy flood and was dangerous for ponies, which were obliged to swim. The ponies are held up and guided by men who cross in the coracle. One of my best ponies, well known in the Darjeeling racecourse, got loose and was nearly drowned, but managed to get on to a shoal in mid-stream, where he stood until rescued.

We left the valley of the Kyi Chu near Dechen Dzong, and going south up a valley, we camped under a cypress tree at a house called Changtsü. The next day we crossed the Gökar La ("White Vulture Pass") at an altitude of 17,000 feet. On the road were wonderful primulas, presumably wild hybrids, for in one clump they were to be found of every colour from pure white, through yellow to deep crimson, the most striking being a clear grey. Other beautiful flowers were blue larkspurs of several varieties, some large-flowered ones being near the summit of the pass among patches of snow. We also passed fine but deadly aconites and patches of yellow and crimson pedicularis and a yellow clematis which is common at Lhasa.

At the pass we entered the valley of a stream which flows into the Tsangpo. As we descended the valley the forest became thicker and thicker, and we were told that it contained stags, leopards, and Harman's pheasants, though travelling down the road we saw no signs of these. To judge by the vegetation, it would seem that the valleys joining the Tsangpo receive a much larger quantity of rain than the actual Tsangpo itself. In 1913 we noticed houses with pent roofs of pine shingles within a few miles of the dry valley where all houses had the usual flat mud roof of Tibet.

A march of 22 miles from Changtsü brought us to Samye. This is an ancient and famous monastery connected with the visit of Guru Rimpoche (the Indian saint, Padma Sambhava), who converted Tibet and Bhutan to Buddhism in the eighth century. On the hill above is a hermitage in which he lived for some time. I said I had not time to visit it, and was

* Note by Ed. *G. J.* The explorer A. K. had of course traversed and roughly mapped the whole of this section on the southern bank in 1882.



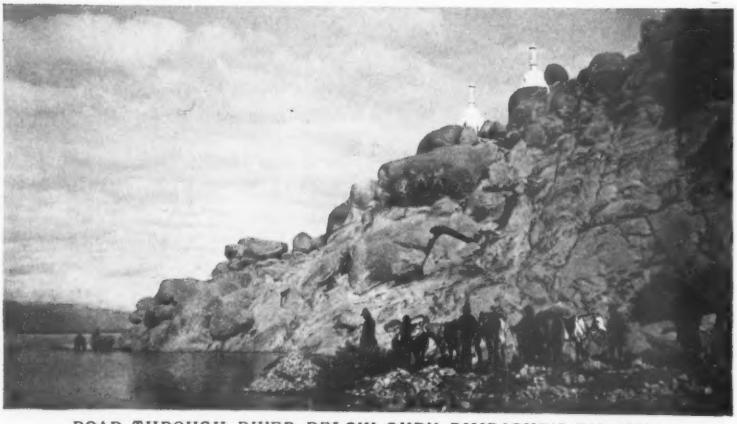
Sketch-map of a part of the Tsangpo to illustrate Major Bailey's note.

THE TSANGPO, LOOKING UPSTREAM FROM NEAR SAMYE

SAND-DUNES NEAR AMYE

CAMP OPPOSITE TSETANG

THE TSANGPO, LOOKING UPSTREAM FROM BELOW DORJE TRA



ROAD THROUGH RIVER BELOW GURU RIMPOCHE'S FINGERS

THE TSANGPO, LOOKING DOWNSTREAM FROM NONG LA

told that to visit Samye without visiting the hermits' caves was like buying a coat without a collar.

The main temple is in three stories supposed to be in Chinese, Tibetan, and Indian styles. At each corner is a coloured *chorten*, or pagoda, white for good, black for evil, red for fire, and green for water. The whole is surrounded by an oval wall on which are a thousand *chortens*. There is one temple into which the breath of every person who dies in the whole world passes at the time of death. The small cross-pieces of the roof are all swords and spears—there must be thousands of them—while outside are three swords each 25 feet long.

A day's journey down the Tsangpo over miles of tiresome sand-dunes brought us opposite to the important town of Tsetang, which Major Morshead and I had visited in 1913. The river was so high that no boat could cross to reach us, and we had to spend an uncomfortable night on a bare hillside with no food for our animals, while across the river, tantalizingly near, was the town among willow trees and crops.

Being unable to cross the river, we were obliged to return up the left bank, an unpleasant, hot march over sand. In winter the road is easier, as it goes over the river-bed instead of over sand-dunes.

We spent a night at Samye, and then continued our march up the left bank.

Soon after leaving Samye we passed five white *chortens* on a rocky spur which ran down to the river's bank. About these we were told the following legend: Guru Rimpoche was coming to Samye, and at this point the king of Tibet met him. At the meeting the king said, "As I am king of the country no one is greater than I," and he refused to salute the holy man. Guru Rimpoche said, "I am a saint, and so superior to all mortals," and he refused to salute the king. Being angry with the king for his arrogance, he produced fire from his five finger-tips and burnt up the king's clothing. The now naked king fell down and worshipped him, saying, "You are indeed a god." Guru Rimpoche was then filled with remorse at his own display of pride and anger, and as a penance he erected the five white chortens, one for each of his fingers out of which he had produced the fire.

Our road was much the same as before: stretches of sand alternating with rocky spurs or steep sand-banks jutting into the river.

About 13 miles from Samye we came to a village called Tra, where the eye was relieved by green crops and willow groves. The hills up the valley appeared to be thickly wooded, and were, we were told, the haunts of Harman's pheasants. Five miles farther we passed a very striking conical rock sticking up in the river, which formed a very useful landmark. It was said to have been floating down to India, but was stopped by Guru Rimpoche. About 5 miles farther we reached the monastery of Dorje Tra, built against a cliff, where we spent the night. This is an important ferry where there was one wooden and several skin

boats. We ourselves crossed in leather boats; the crossing took one and a half hours. When nearing the south bank we had to work our way through many sandy islands, which delayed us. In winter these islands are part of a wide stretch of sand, and the crossing is much shorter. We made a delightful camp on turf under willows at the village at Tö, or Chi-te Shö. The people had never seen a European, and were very curious to see what we were like.

Our ponies were crossing in a wooden boat, which had to go for a long way down and be pulled up past the islands to the end of the Nong La spur, which was the only place where they could be landed. They did not reach there till the next day.

On August 22 we marched 20 miles up the south bank to Gongkar Dzong. From a spur of the Nong La, 400 feet above the river, we had splendid views of the broad valley both up and down stream. We descended and continued up the flat valley. There were numbers of Bar-headed geese on the river-bank, which were so tame that I was able to get some photographs of them.

The next day I visited the Dzongpen of Gongkar. In 1904 he had been one of the Garpons, the officials at the Gartok trade mart in Western Tibet. We had met when I went there with the late General Rawling, Colonel Ryder, and Colonel Wood of the Survey of India.

Six miles from Gongkar we crossed the Yab La, a spur about 500 feet above the river. At the end of this spur is the ferry of Chaksam, where the expedition under Sir Francis Younghusband crossed the Tsangpo in 1904. We were now on well-known ground. We camped the night at Singma Kangchung, whence we telephoned to His Holiness the Dalai Lama to tell him we had rejoined the main road.

When in Lhasa the Tsarong Shape had asked me about the possibility of using motor boats on the Tsangpo, and at his request I measured the velocity as well as I could in some of the more rapid places and found it to be between 5 and 6 miles an hour.

We returned to Gyantse by the usual road *viâ* Nangartse, the Karo La, and Ralung.

THE ROUNA FALLS OF PAPUA

T. J. Lindsay Dowsett

SOME 23 miles from Port Moresby, the seat of Government in the Territory of Papua, are the Rouna Falls,* which for beauty, picturesque surroundings, and prospects of immediate economic

* We retain the spelling used by Mr. Dowsett, which is that usually adopted on maps. It does not seem certain however whether the vowel sound in the first syllable is diphthongal ("Ro-una") or whether "Rona" or "Runa" would be the correct spelling according to the R.G.S. system.

development rank with any other falls within the Empire. But little is known of them outside the Territory. Even in Australia many people have only a slight knowledge of the Territory and its physical features, so that a short account of these falls may be of interest.

The best time of the year to see the falls is the interval of the wet season, extending from December to February, when the largest volume of water passes over the brink. It is preferable to leave Port Moresby in the afternoon and spend the night at the accommodation or rest-house at Sapphire Creek, a tributary of the Laloki River, about 17 miles from the township. Next morning, on leaving the rest-house the visitor is confronted with a precipitous mass of rock known as the Hombron Bluff, dominating the small area of flat country in the locality. This bluff extends in a south-easterly direction for over 6 miles with an almost level top which, when a mist is present, recalls Table Mountain, Cape Town, and its accompanying "tablecloth." This ridge is the southern extremity of a tableland which reaches to the high mountain ranges of the interior, the greater part of which is known as the Sogeri District. On this tableland there are several rubber plantations from which excellent yields are obtained.

The falls are to the east of the rest-house. On the left of the narrow gorge through which the Laloki River flows rises Hombron Bluff; on the right, the termination of the Astrolabe Range, Mount Warirata, 2615 feet high.

For many miles around the countryside is scattered with huge boulders which, many centuries ago, were precipitated from a crater on the southern slope of the Hombron Bluff. This crater, now extinct, is filled with water, and is enclosed with a thick mass of tropical scrub and tangled vines. This particular spot is reputed to be the abode of a large number of pythons; one specimen, killed a few years ago, measured nearly 23 feet in length.

Leaving the rest-house at Sapphire Creek, the road follows closely the river into the gorge formed by the converging arms of the bluff and the Astrolabe Mountains. About 5 miles up this narrowing gorge the mountainous sides approach to within 100 feet of each other. It is at this point that the falls occur. The northern wall of the gorge is precipitous practically throughout its length. The southern wall for nearly 4 miles rises from the river-bed with a steep slope of about 800 feet: the remainder, sheer precipice, averages 600 feet in height. From the point of 4 miles within the gorge the slope becomes much steeper and gradually possesses the same characteristics as the northern wall. On the slopes of the mountains are deposited large boulders of volcanic origin, some of them being many tons in weight. These boulders supply excellent material for the construction of the Government road which is intended to pass close to the falls and to continue on to the rubber plantations of the tableland.

The path of the river itself is impeded with boulders, over and around which the stream swirls madly until, in the vicinity of its tributary, the Goldie River, it enters an extensive plain, highly suitable for agriculture. Some distance down the river from its tributary rises a solitary peak, Mount Lawes, nearly 1000 feet high. On entering the gorge the sullen roar of the falls is barely discernible above the noisy rush of the turbulent river, whilst overhead flocks of cockatoos screech.

The Government road has been built only for a distance of about $3\frac{1}{2}$ miles. From thence one climbs up a steep path in an almost straight line for about 300 feet and emerges on to a grassy patch of a few acres in area. The falls are discernible about a mile ahead. A thick envelope of spray surrounds the bottom of the falls, and is intermittently wafted up the precipitous sides of the northern wall. From this point on the grass patch a private road is in course of construction to the foot of the falls. When completed, the necessary machinery for the establishment of a power station will be carried to a site some few yards from the foot of the falls. At present the terminus of the private road is in the midst of an almost impenetrable scrub, which abounds with entomological life. The Government road is to be built on the slope above the other road, and, from the rugged nature of the terrain, will be very expensive. At present it is defined by a narrow track, and it is from this track that the best views of the falls are obtained.

After a strenuous passage of half an hour through a dense moist scrub one reaches a series of narrow shelves strewn with volcanic conglomerates and partly overgrown with kuri-kuri grass. The lower shelf terminates at the top of the southern precipice adjacent to the falls, and by leaning over, the latter can be seen 40 feet below. From here also can be seen the pool at the foot of the falls nearly 250 feet below. The perpendicular height of the falls proper is 210 feet, and the width (at the time of writing) about 30 yards. From the foot of the falls the river continues to descend rapidly ; at a distance of 100 yards it has fallen a total distance of 320 feet. At 400 yards the river has fallen 500 feet, and 4 miles further almost 800 feet.

About 150 yards higher up the river from the falls there is another small fall of about 25 feet. Above this again the course of the river is over scattered boulders and through narrow gorges. Here, as in the lower gorge, the river consists for the greater part of a series of deep pools connected by shallow rapids.

According to barometrical measurements, the falls are 1316 feet above sea-level. The average depth of the river, within the gorges, appears to be (May) about 6 feet. It is difficult for an amateur to obtain anything like accurate results on account of the exceedingly rugged nature of the country and the insecure footholds afforded. Most of my measurements were taken with a length of twine, to one end of which was attached a linen bag containing an iron bolt-head, the twine being

measured in sections of feet. By means of floating pieces of wood dropped in the middle of the stream between the two falls, I found that the velocity of the water was nearly 80 feet per minute, and estimated that 16,000 cubic feet of water passed over the falls per minute.

From observations taken during the month of August, which is, in this region, the driest month of the year, the velocity of the stream at a mile above the falls was 44 feet a minute, and 12,000 cubic feet of water flowing over the brink per minute. From rainfall records it may be seen that during the " wet " season extending from November to February, the volume of water is enormously enlarged. It has been estimated that during the " dry " season, the flow of water over the falls represents a force of 20,000 to 40,000 horse-power.

The rocks surrounding the falls consist of conglomerate intermixed with river gravel, volcanic conglomerates, and masses of basalt and andesite. On the northern wall of the gorge are patches showing various tinted vertical columns, giving an appearance of organ pipes. On this same wall during the wet season appear several smaller falls, some of which are over 400 feet in height. What water does come down from the northern wall is possessed of crystalline clarity, whilst that which descends from the Astrolabe Range is mainly light blue or greenish, indicating the presence of copper ores in its track. The downward slope to the Gasiri Valley and also in the direction of Bisiatabu and Koitakinumu accounts for the small amount of water flowing down the southern slope of the bluff. The greater volume of cloud and mist that prevails around Warirata and its greater accessibility to the north-west and south-east winds produce throughout the year several small watercourses flowing down the southern wall of the gorge.

The vegetation within the lower gorge grows for the greater part on the Astrolabe slope. Australian varieties of eucalyptus, and innumerable tangles of tropical creeper vines interwoven with many varieties of ferns, lalang, and kuri-kuri grasses are in general evidence. The grasses mentioned are possessed of sharp edges, and in several spots I found the kuri-kuri grass exceeding 6 feet in height. Several of the plantations in Papua have imported cattle to keep down the growth of kuri-kuri and other grasses and weeds, the projected result being the dispensing with a large quantity of native labour and in the long run an increased annual saving in working costs.

A concession has recently been given to private enterprise to harness the Rouna Falls and generate electric power It is intended, in the first instance, to treat the copper ore obtained from the several mines in the Astrolabe Mountains. At one mine, the Laloki, over 200,000 tons of ore are estimated to be in sight, and a further estimate places this amount as representing only 8 per cent. of the ore contained in the Astrolabe mineral field. The ore, which has an average of 4 per cent. copper, is

enriched by the addition of 3 or 4 pennyweights of gold to the ton, with a slightly larger amount of silver.

The ore is regarded as being capable of treatment at a comparatively low cost on account of the presence of large percentages of sulphur and silicate of alumina. After being smelted at the smelters, now in course of construction at Bootless Inlet, the product is " blister copper " of 99 per cent. purity. Apart from the large amount of power required for the treatment plants, it is estimated that there remains sufficient to supply Port Moresby and the surrounding plantations within a distance of 16 miles of the power house with electric light, heat, and power. With such facilities available much of the discomfort endured by residence within the tropics would be alleviated.

Some mention may be made here of the native peoples in the Rouna Falls district. On the advent of the whites and the establishment of the seat of government at Port Moresby, the Koiari tribe, who ranged over the country extending from the mountain ranges at the rear of Iavarere to the coastal areas, withdrew from contact with the whites, and in succeeding years have gradually retired to the mountain ranges of the interior. In bygone days this tribe was renowned amongst the coastal groups and also the tribes on the eastern slopes of the dividing range as being of the most fierce and violent temperament, besides possessing the strongest " magic." This prestige remains attached to them, although Government Regulations and influence have caused them to abandon many of their savage and murderous rites. It is difficult to obtain labour recruits from the Koiaris on account of their sullen pride and isolation. Indications are present that in the near future, with careful and tactful handling, they will become more accessible. Several residents of the territory have stated that as labourers the Koiari " boys " are hard to beat. The wearing of white cockatoo feathers—a sign of impending war or raids—has now been prohibited. The neighbouring tribes never dare to venture far from their homes at night for fear of being overcome by the Koiaris. Fatalities and accidents are ascribed to the powerful puri-puri of their dreaded neighbours, and several " christianised " natives from the coastal villages, with whom I have come into contact, do not hesitate to regard with awe the " magic " woven by the Koiari tribe. Puri-puri is the name given by the Motuans to the practice of witchcraft and magic by the sorcerers of the tribe, and sometimes by the tribe as a whole. The word is synonymous with the West African ju-ju. Save for a few scattered houses on the Astrolabe Mountains, the tribe is not met with in any great numbers until one reaches the vicinity of Iavarere Plantation. The last murder of a white man by these natives occurred some six years ago on the outskirts of this plantation. Since then there have been records of natives being murdered ; and away in the mountain fastnesses, it is rumoured, internecine strife still continues.

The overland mail to Kokoda, from whence it is despatched to Ioma and Buna, is carried by natives accompanied by a few members of the Native Constabulary. Nowadays they are not molested in any way in passing through the country inhabited by the Koiari tribe. The mail route, which is approximately 100 miles long, traverses the high mountain range—the Owen Stanley Range—that forms the watershed between the river systems of the north and north-eastern slopes and that of the south-western slope. The time taken to carry the mail through, with relays, is seven days, but only recently a patrol officer arrived in Port Moresby from Kokoda after a journey of four days. For many miles the track rises over steep slopes and high mountains and abruptly descends into deep gorges and ravines, crossing swirling streams by means of suspension bridges that are, to the novice's eyes, frail and insecure.

With the economic development of the Rouna Falls there will begin a new era of commercial prosperity for Papua that, together with the increased areas under cultivation and the development of further mineral resources, will make Papua the wealthiest of the Pacific territory.

THE ORIGIN OF THE SALTS IN THE JORDAN

Wilfred Irwin

IN 1923 I read a paper on the Salts of the Dead Sea before the Geographical Society [*Geogr. Journ.*, 61, 428]. In it I showed that, accepting the rate of flow of the Jordan as estimated by various authorities, about 1 million tons per annum of the mixed chlorides of sodium and magnesium were brought down by the river and delivered into the Dead Sea.

To discover the source or sources of these salts has been with me a constant endeavour, and I have analysed a large number of samples of water collected for me by Mr. Philby and others since the publication of the first paper.

I have not yet been able to obtain samples from all the sources I require by any means, but our Secretary thinks it would be advisable for me to report on those I have examined so far, in the hope of being able to obtain more at a future time.

Let me take those from the river Jordan itself, beginning near its mouth.

I. Sample taken just above Allenby Bridge, river low, 29/8/23.

II. Sample taken just above Allenby Bridge, in flood, 30/1/24.

III. Sample taken just above Allenby Bridge, river low, 17/11/23.

IV. Sample taken 50 yards from outlet of Lake of Tiberias, moderate, 12/4/24.

IVA. Sample taken at outflow of Lake of Tiberias in 1922.

V. Sample taken at Et Tabgha at north end of Tiberias, moderate, 12/4/24.

VI. Sample taken just below Lake Hule, 12/9/23.

	River Jordan.		Parts per Million.				
	I.	II.	III.	IV.	IVa.	V.	VI.
Chlorine, Cl ...	316	332	495	243	240	207	9·6
Sodium, Na	117·1	160	242	—	133	—	10
Magnesium, Mg ...	62·4	45	63	—	28·5	—	7·8
Calcium, Ca ...	73·3	82	98	—	48	—	46·0
Sulphate, SO_4 ...	6·3	54	12	—	38	—	5·6
Carbonate, CO_3 ...	165	75	75	—	—	—	60·0
Silica, SiO_2	16·0	35	26	—	13	—	10·0
Alumina, Al_2O_3 ...	20·0	25	23	—	—	—	14·0
Sulphuretted Hydrogen, H_2S ...	—	—	Distinct odour	—	—	—	—
Sp. gravity	—	—	1·0008	—	—	—	—

From the above it will be noticed that in the lower part of the river the rate of flow has a distinct influence on the amount of salt it contains. This is what one might expect, but even in flood-time there are as many as 316 parts of chlorine per million at the Allenby Bridge. This is due principally, no doubt, to the large store of water always retained in Lake of Tiberias, the outflow of which as late as April 12 contained 243 parts of chlorine per million. The quantity of water in the lake is so great that I calculate it would take two or three years for the Jordan water to pass through it. The sample taken at the north end of the lake on the same date showing 207 parts of chlorine seems to indicate that no very great addition takes place in the passage through the lake itself.

The first five tests agree fairly well with those published by me in my paper read before the Society in 1923, but the last test, that from a sample taken from below Lake Hule, is quite different, only resembling in its composition that of an ordinary hard water. I have tried to obtain further samples of the river between Hule and Tiberias, but so far without result, though I am still making every effort.

The following are the analyses which I have made of several springs and rivulets from the Jordan valley. They have for the most part been taken and supplied to me by Mr. Philby.

I. Wadi el Qelt, from the short canal 3 miles above Jericho. All the water from the Wadi is taken off by this canal and absorbed in irrigation. Only in flood-time does water reach the Jordan. It is 500 feet above sea-level. Sample taken 28/8/23.

II. 'Ain Sultan, or Elisha's Fountain, at Jericho. Sample taken 28/9/23.

III. 'Ain Malih. Brackish spring below Allenby Bridge. Sample taken 28/9/23.

IV. 'Ain Malih. Sample taken 30/1/24.

V. Spring at Es Salt forming the virtual source of the Wadi Sha'ib, 2700 feet above sea-level. Sample taken 28/8/23.

VI. Wadi Sha'ib at Shunet, Nimrin Canal. All the water flows into the canal and is absorbed by irrigation. None reaches the Jordan except in flood-time. 720 feet above sea-level. Sample taken 28/8/23

VII. Ras el 'Ain 1 mile above 'Amman, the source of the Jabbok or Wadi Zerqa. Only in flood-time does any water reach the Pools of Zerqa. 2800 feet above sea-level. Sample taken 17/9/23.

VIII. Spring near pump house on right bank of the Jabbok or Wadi Zerqa, 2100 feet above sea-level. Sample taken 23/8/23.

IX. 'Ain Karfa fountain 4 miles below Es Salt on main road to Jerusalem, a tributary of the Wadi Sha'ib in flood-time, 28/9/23.

X. Tell esh Shehab Waterfall, head of Yarmuk valley. Sample taken 11/11/23.

XI. River Yarmuk before its entrance into the Jordan after it has received all its tributaries. Taken 12/4/24.

XII. 'Ain Rib hot spring at Hamma; contains H_2S. Taken 12/4/23.

XIII. 'Ain Megla. Very hot spring at Hamma. 12/4/24.

XIV. 'Ain Jerab. Fresh spring at Hamma. 12/4/24.

XV. Hot spring near Tiberias, 140° F. temp.

Rivers in Syria outside the Jordan Valley.

XVI. Barada above Damascus (Philby).

XVII. River Litani, near mouth (T. Cortas).

XVIII. Dog River (Nahr el Kelb), near mouth (T. Cortas).

Mediterranean Sea.

XIX. Sample taken 100 miles east of Gibraltar (Self).

XX. Sample taken near Naples (Self).

Limestone.

XXI. From quarry under Jerusalem (Self).

ANALYSES OF VARIOUS SPRINGS AND RIVERS IN THE JORDAN VALLEY. PARTS PER MILLION.

	1	2	3	4	5	6	7	8	9
Chlorine, Cl ...	24·3	21	1517	1517	51·5	46	20	44·5	34
Sodium, Na ...	2·3	16	774	774	36·3	31	14	29·5	13
Magnesium, Mg	15·5	12	198	198	24·1	13·8	31·3	5·0	23
Calcium, Ca ...	28·6	49	206	206	102	21·6	63·3	50·0	59
Sulphate, SO_4...	9·0	18	290	290	19·5	13·6	8·1	9·6	22
Silica, SiO_2 ...	8·3	3	85	85	22	14	8·3	10·0	13
Alumina, Al_2O_3	nil	23	—	—	—	18	33·3	33·3	13
Carbonate, CO_3	90	144	216	216	195	105	112	—	195
Sulphuretted Hydrogen, H_2S	—	—	trace		—	—	—	trace	none
Sp. gr.	—	—	1.00276	1.00276	—	—	—	—	—

	10	11	12	13	14	15	16	17	18
Chlorine, Cl ...	40	79	206	431	297	18,340	6	10	8·5
Sodium, Na ...	10	—	—	224	172	6,970	4	4·9	4·2
Magnesium, Mg	25	—	—	42	31	820	10·9	12	6·5
Calcium, Ca ...	16	—	—	145	97	3,130	48·0	73	49
Sulphate, SO_4...	31	—	—	130	—	540	11·5	9·6	12
Silica, SiO_2 ...	13	—	—	—	—	—	4	6·6	10
Alumina, Al_2O_3	7	—	—	—	48	—	8	—	—
Carbonate, CO_3	75	135	—	170	195	—	112	—	84
Sulphuretted Hydrogen, H_2S	none	—	trace	trace	—	none	none	none	none
Sp. gr. — ...	—	—	—	—	—	1·0229	—	—	—

Let us see what conclusions we may deduce from all these analyses, and commence by considering the tests made of springs and rivers between the Lake of Tiberias and the Dead Sea.

The first is that the general composition of the waters of the district do not differ much from what one would expect in a region where the rainfall is low and the evaporation high. Chlorine is the most important element affecting the composition of the Dead Sea, and also a substance which can be readily estimated with considerable accuracy. Now I have shown that all rain-water contains more or less of this substance, differing in amount according to the distance from the sea, and not to any great extent with the rainfall. The salt is taken down by the rain and so carried by the rivers back again into the sea. The rain in my own county (Cumberland) contains an average of 5 to 6 parts of chlorine per million, and the rivers 7 to 8 parts per million. The Rhine at Coblenz, from a sample taken by me last summer when the river was in flood, showed 7 parts per million. The rain in the Jordan Valley will probably contain 5 to 6 parts of Cl per million, and up to 90 per cent. of the rain-water might be lost by evaporation, leaving the proportion of Cl say 50 parts per million in the river waters, so I should say anything up to this figure could have its origin in the rain-water. As the contents of chlorine in the Jordan itself vary from 316 to 495 parts per million according to the season of the year, very few of these ordinary springs and streams can add to its salinity. Indeed, the reverse will be the case.

It occurred to me that the Yarmuk, by far the largest tributary of the Jordan, and having its origin in the volcanic district of the Hauran, might contain sufficient Cl to add to the salinity of the Jordan, but samples taken for me by Mr. Philby showed that it only contained 40 parts at the Shehab Waterfall at the head of the Yarmuk valley, and only 79 parts per million at its fall into the Jordan, and this in spite of the hot mineral springs which it receives at Hamma. There is one stable quality in the saline content of the Jordan, and that is the percentage of Cl as it leaves the Lake of Tiberias. An analysis made many years ago by Christie showed a content of 240 parts of Cl per million, one made by me three years ago showed 240 parts also, and the last one I made of sample sent me by Mr. Philby showed 243 parts. This seems to show that the saline additions in the upper reaches remain very constant.

By the time the river reaches Allenby Bridge, however, in spite of the addition in volume which it has received from the Yarmuk and other tributaries, the chlorine has risen to 316 in August, and 495 in November, when it was at its lowest, to return to 332 in the following January when it was in flood. This shows clearly that the river must have received a large accession of salt between these two places, though whence I have so far been unable to discover. It is possible that there is a huge saline spring in the bed of the river. Shortly below the Allenby Bridge there is a slightly saline spring, the 'Ain Malih, from which I have had samples

taken on two different occasions, the first before the rains of 28/9/23, and the second after the rains. They both showed practically the same result, 1517 of chlorine per million, not sufficient to alter materially the composition of the river. I calculate that about two-thirds of the Cl in the lower Jordan comes all the way down from Lake of Tiberias.

Two of the samples taken from the springs at Hamma near the Yarmuk contained H_2S in April 1924, but there was not sufficient to influence the river itself, the sulphur being evidently oxidized by the air which would be dissolved in the river on its way down from the Hauran. The spring near the pump-house on the right bank of the Wadi Zerqa also contained H_2S. During the greater part of the year H_2S cannot be detected in the Jordan itself, but at the time of least volume, towards the end of November, there is a distinct odour of H_2S in the river, though not sufficient for me to determine in the small sample I received.

In regard to the spring, 'Ain Sultan, or Elisha's Fountain—the spring which causes the oasis, and makes it possible for the town of Jericho to exist, and which according to the biblical account the prophet Elisha purified by ceremoniously dropping salt into it—it is interesting to find that it is the purest of all the waters that I have tested in the Jordan valley.

So much for the samples of water which I have tested south of the Sea of Galilee. I have tried to obtain several samples in the neighbourhood of and north of that sea, but so far only one has been sent me, and that is from the hot spring near the town of Tiberias on the west side of the lake. It was considered to be a medicinal spring in Roman times; there were baths in connection with it then, and there have been through the centuries, though they are in a dilapidated and ruinous state now. It is a spring of very considerable volume, and the water from it flows straight into the lake. Its temperature is 140° F. I had never previously seen an analysis of the water, and was greatly interested in testing it. I naturally first estimated the quantity of chlorine in it, and found it to contain nearly the same as the Mediterranean Sea, and I began to wonder whether the theory that infiltration from the outside sea was the source of salts of Jordan and Dead Sea was correct. Further investigation, however, showed that this is most improbable. The following is my analysis of the spring and also of two samples of water taken last spring by me from the Mediterranean Sea :—

COMPARISON OF TIBERIAS SPRING WITH MEDITERRANEAN.

Parts per million.		*Tiberias.*	100 *miles E. of Gibraltar.*	*Near Naples.*
Cl	...	18,340	20,360	21,070
Na	...	6,970	11,410	12,660
Mg	...	820	1,290	1,120
Ca	...	3,130	460	310
SO_4	...	540	2,570	3,180

Percentages of	*Tiberias.*	100 *miles E. of Gibraltar.*	*Near Naples.*
NaCl ...	59·4	80·4	84·0
$MgCl_2$ ...	9·2	7·1	3·3
$CaCl_2$ ...	29·1	3·5	2·2
$MgSO_4$ ...	2·3	8·9	10·5

As this spring at Tiberias is the first feeder of the waters of the Jordan I have tested which contains salts at all sufficient to influence materially its salinity, I wish to refer to it fully It is quite clear, from the character of the salts it contains, that it does not owe its origin to infiltration from the Mediterranean, otherwise the percentage of calcium chloride would not have been so high. In the spring the $CaCl_2$ is in quantity nearly three times that of $MgCl_2$ and $MgSO_4$ together, whilst in sea water it is only one-fifth.

It is quite probable that there are many other springs in the Jordan valley similar in salinity to this one. If the other springs are similar, how can they supply the large quantity of Magnesium chloride which the Jordan and Dead Sea contain? It has occurred to me that the interaction of the $CaCl_2$ on the magnesium carbonate, which the rocks in the Jordan valley are said to contain, and which are carried down to the river by the streams, may be one cause for the presence of $MgCl_2$ in the river. I have tried mixing $CaCl_2$ in solution with insoluble $MgCO_3$, and the result is the formation of the soluble $MgCl_2$ and the insoluble $CaCO_3$. I do not know whether there is sufficient $MgCO_3$ in the sediment brought down by the Jordan and its tributaries to account for all the $MgCl_2$ present, but I throw this out as a suggestion. I have analysed a sample of limestone from Solomon's quarry under Jerusalem which I brought back with me, and find but little $MgCO_3$ in it. The following is the analysis:

$CaCO_3$	98·59
$MgCO_3$	0·80
AlO_3	0·65
	100·04

This does not bring us much nearer, as this stratum is evidently a very pure $CaCO_3$. Much of the rock in the Jordan valley I believe contains more Mg in its composition, and more investigation is required before a true account on the source of the salts of the Jordan can be given.

The last three in the table are the analyses of samples of water taken from rivers in the north of Syria, the first two supplied by Mr. T. Cortas and the third by Mr. Philby. They clearly indicate that rivers in that district which have their origin in localities of high rainfall, contain chlorides in normal quantity, very like unpolluted rivers in this country.

I have said that the Jordan carries down each year into the Dead Sea about 1,000,000 tons of mixed chlorides of sodium and magnesium. This is just about the amount of salt which I calculate is washed down by the rain in England and Wales from the air and carried back again by the

rivers into the sea. The area of the Jordan watershed is about one-sixth that of England and Wales, and the average rainfall much lower; hence the maximum received from this source would not be more than one-sixth of the amount of salt it contains.

In the analysis here recorded I have left out of account the potassium and bromine, which are present only in minute quantities, but which accumulate in the Dead Sea by the evaporation of the water and the crystallization of the sodium chloride. There is a possibility of their having an economic value in the sea itself, but that they can ever be extracted commercially from the springs is very improbable.

In my analyses any potassium present would be included in the sodium figure, and any bromine in the chlorine figure.

From the analyses given we may note three different kinds of springs:

(*a*) Those having their origin in rain-water directly which has partially evaporated after having dissolved the lime and magnesia from the strata through which it has percolated, *e.g.* the springs at Jericho and Es Salt.

(*b*) Those having deeper connections (possibly with the Jordan fault), such as 'Ain Malih and 'Ain Megla.

(*c*) The hot spring at Tiberias, whose waters come from volcanic rocks of unknown depths below the surface.

RECENT PRODUCTIONS OF THE ORDNANCE SURVEY

Captain J. G. Withycombe

Read at the Meeting of the British Association, Southampton, in Section E (Geography).

THE title chosen by the President of this Section for his address suggests that map-making may be regarded from two distinct standpoints—the scientific and the artistic. One of the chief pre-occupations of the cartographer should be to reconcile these two aspects; to produce a beautiful map which is also accurate and legible. Just as good literary style is of the utmost practical value in the presentation of scientific facts in a book or pamphlet, so good cartographic style enhances the practical value of a map besides converting it from a dry statement of facts into a thing of beauty.

In modern times there has been a tendency all over the world to lose sight altogether of the artistic aspect of maps, and most of the productions of the present day compare very unfavourably with those of the sixteenth and seventeenth centuries in this respect. Perhaps it is because the tradition of the old map engravers has been preserved, to some extent, in the Ordnance Survey that the sheets of the 1-inch map still have an æsthetic appeal. Mr. Aldous Huxley recognizes this in a recent article in which he advocates their use purely as pieces of decoration; after

speaking of the beauty of the work of the mediæval mapmakers he says, " It is possible to make a charming decoration out of the most accurate and efficient of modern maps. The Ordnance Survey printed in five colours is a beautiful thing to look at, and one can imagine a panel, or a whole wall of a study richly and interestingly adorned with a slice of England reduced to the scale of an inch to the mile." I think he refers to the Popular Edition of England and Wales; what he says sets one thinking over what it will be possible to do in future to make the 1-inch a still more " beautiful thing to look at."

The style of the Ordnance Survey small-scale maps is traditional; their evolution can be traced direct to the sixteenth century, and beyond that to the Middle Ages. The first maps produced by the Department were those of the south of England on the scale of 1 inch to 1 mile, which were prepared and published during the first two decades of the nineteenth century under Colonel Mudge in the Tower of London. One has only to glance at them to realize that they are a product of a well-established tradition, the work of expert craftsmen who worked in a style which has already become set. It is a fascinating study to trace the development of this tradition from Christopher Saxton in the latter half of the sixteenth century on through the successive generations of English cartographers—John Norden, Ogilby, John Cary, and the rest—to the foundation of the Ordnance Survey and so to the present day. It is interesting to note the influence of methods of reproduction on the style. For instance, although the script used in the sixteenth century was engraved, it still retained the character of the letters written with a reed pen; gradually the engraver converted it into a type of script writing better suited for engraving. The beautiful Roman letters which had been used by earliest map makers underwent a similar change, the serifs or capitals became exaggerated, the up-strokes became fine " hair " lines and the character of the letter was entirely changed by the end of the eighteenth century. So long as copper-plate printing was employed as the only means of reproduction there was very little scope for further development. As engraved maps these 1-inch and early 6-inch sheets are very complete, and one feels that any alteration would destroy their balance and spoil them.

The introduction of lithography revolutionized everything. It became possible to print maps in many colours, and the demand for coloured maps was insistent. The engravers' tradition remained, however, and, although the large-scale plans were lithographed direct very soon after the introduction of the process, the 1-inch map was still engraved and the transfers pulled from the copper plates were laid down on the lithographic stones or zinc plates. The present 1-inch map of England and Wales has been produced by this method, and is therefore a compromise between engraving and the newer process.

Perhaps the strongest reason for the retention of the copper plate as the basis of the map is that it constitutes a permanent record, practically

indestructible, the size and shape of which remains stable, and upon which alterations and additions can be made; but the process of transferring from copper to stone has not been found altogether satisfactory. In order to make the various colour plates the contours and water had been separated from the outline on the copper plates, and great difficulty was experienced in securing the perfect fit or register of the zinc plates, for although the copper plates themselves measured correctly, the transfers which were on paper were liable to expansion and contraction. In addition to this it was realized that a map primarily designed for copper-plate engraving was not adapted for reproduction by the zincographic process. Much of the very fine work was coarsened, or failed to appear on the zinc after the process of transferring, whilst the adjustments, slight as they were, which had to be made to secure register affected the accuracy of the map, and as time goes on greater accuracy is required, especially for military purposes. Accordingly it has been decided, at last, to abandon engraving altogether and to draw the map for direct reproduction by the process of helio-zincography.

We are feeling our way with the new 1-inch series of Scotland, four sheets of which have already been published. These are the latest production of the Survey, and as the smaller scales, ½ inch, ¼ inch, 10 mile, and 1/1,000,000 are all derived from the 1-inch, the character of these Scottish sheets will largely influence that of all the future small-scale maps of this country.

My reason for dwelling on the history of the 1-inch map and its development is that to-day we are at the parting of the ways. The next edition of England and Wales will be re-plotted and drawn *de novo*. It is hoped to produce a map designed to be drawn on paper and adapted for reproduction by the helio-zincograph process, which will retain the traditional style, which is a good one and thoroughly English, adapting it to modern requirements and to the new process where necessary, but making no violent break with the past.

The adoption of the new method has rendered it possible to make some improvements, which have increased the value of the maps. For instance, each sheet has been made to overlap its neighbours 1 inch in all directions. This is a great convenience which will be appreciated by all users of the series.

Hitherto the 1-inch maps of Scotland have been on Bonne's projection and based on the meridian of 4° W. of Greenwich. The new map has been transferred to Cassini and the meridian of Delamere 2° 41′ 3″ W. of Greenwich, on which the maps of England and Wales are drawn. This has made it possible to carry the sheet lines of the English series through into Scotland and to avoid all overlapping and confusion on the border.

In considering the details of the construction of a map it is convenient to divide the features into two classes: Natural and Man-made. Among

the former the representation of land-forms is necessarily of the utmost importance, and there has been, and still is, considerable difference of opinion as to the best system. The method of indicating relief has undergone great changes ; the first geographers depicted hills as a series of humps, drawn in perspective ; gradually these pictured hills gave way to hachures, the hills being shown in plan with their slopes shaded to indicate varying degrees of steepness ; this method lent itself peculiarly well to engraving, and held the field throughout the nineteenth century. After the introduction of contours the hachures were still printed in addition to the contour lines ; they appear on the current edition of the Scottish map and on the large-sheet series of England and Wales, which has just been superseded. They have now been discarded and the latest 1-inch sheets show contours only, or for the Tourist District Maps, contours with layer colouring.

One cannot help regretting the passing of the hachured hills which did so much to enhance the beauty and usefulness of the old engraved maps, and which have proved effective even in combination with contours, shading, and layer colouring ; but contours have a certain beauty of their own, and they serve to indicate the land forms more precisely than the pictorial method could do. On the new map they are drawn at vertical intervals of 50 feet from sea-level to the summits instead of at 100-feet intervals up to 1000 feet and thence at 250-feet intervals as on the present Scottish map. When the contours were left without the support of the hachures on the maps of the Popular Edition of England and Wales it was found that the ground forms were very often difficult to follow, but this defect has been overcome on the latest maps by thickening the lines at 250 feet, 500 feet, and so on at 250-feet intervals. This device brings out the shapes of the hills and facilitates the reading of the contours in a remarkable way. Another minor improvement is the provision of more contour figures than has been customary of late years.

Up to the commencement of the present revision, water was shown by means of engraved "water lining" ; this was abolished, as it was found to be confusing when used in combination with sea-bed contours, and on the Popular Edition of England and Wales rivers are shown by a thick blue line which was inferior in appearance to the water-lined streams which it superseded. On the new map inland water is outlined in blue and filled with a blue tint, which gives a pleasing effect and clear definition to the streams.

Most of the ornamental features of the engraved map have been retained, and the draftsmen have been successful in depicting sand, rocks, woods, marsh, moorland and parks even more clearly than their predecessors, the engravers. Several of the draftsmen employed on this work are ex-engravers who have exchanged their engraving tools for the pen quite recently.

Physical features change little ; it is with man-made features that

the revisers are principally concerned. The enormous development which has taken place during the past forty years has rendered the task of mapping the country on the small scale of 1 inch to 1 mile an increasingly difficult one. The danger of overcrowding the maps is very great, and much judgment has to be used in the selection and generalization of material.

All houses on the new map are blocked in, in solid black. The advantages of this over the former method of hatching are that the shapes can be better defined, that the streets in towns stand out more clearly, that the towns themselves tell out on the map in a manner which approximates to their relative importance. With the growth of motor traffic the showing of the roads and their classification has become a consideration of the first importance. It has been thought by some critics that we have over-emphasized the main roads. Possibly they are right, and these roads, coloured a strong red as they are, are a little too wide and tend to overpower the surrounding detail.

The great alterations and additions to the road system since the revision of the South of England was carried out necessitated the making of a special road revision. This has just been completed for the London area and the South Coast, and future reprints of the 1-inch, ½-inch, and ¼-inch sheets will show the new arterial and other roads open for traffic or under construction and all alterations to classification of the old highways. The special sheets London North and London South with this information have already been published.

The archæological information on the recent maps has been revised by the Archæology Officer, and the 1-inch in this respect has been much improved. Mr. Crawford is dealing with this matter in the paper he is reading to this Section, and I shall not dwell upon it.

For the smaller scales derived from the 1-inch, the detail is selected, generalized, and exaggerated in order to suit it for reduction. Last year the publication of the new ¼-inch map of Great Britain was completed, by drawing in black over prints in blue of the ½-inch map. The detail to be shown on the ¼-inch scale was selected and exaggerated sufficiently to stand reduction to half, and all the names were re-written larger to ensure their legibility.

Although this map may be regarded as the standard motoring map of the country, the main roads being emphasized and coloured red, the contours and layer colouring, together with the sea-bed contours, convert it into a useful physical map which can be adapted to a variety of uses. It has been much used by airmen, as the scale is very convenient for flying, and it serves as a basis for the special air map which is being prepared. Attention is now being paid to the delineation upon it by means of special symbols of aerodromes, seaplane stations, landing grounds, air lighthouses, wireless stations, and other features bearing upon its use as an air map. A large special sheet—South Central England—has

been prepared; it covers London, Birmingham and Bath with the South Coast. This sheet has been found valuable for many purposes.

The first sheet of the new map on the scale of 10 miles to 1 inch is now being printed. It is designed primarily as a road map. The whole of Great Britain will be covered by three sheets, and a liberal overlap of 6 inches is provided. Sheet 3 includes the whole of Wales and England south of the Humber. The contours, which are drawn at 200 and 400 feet and thence at 400-feet intervals, together with the layer colours, emphasize the relief without obscuring the roads and detail. The coast-line is printed in blue, with the water—as is done on the International 1/1,000,000 maps. This makes it possible to separate the complete physical map from the black plate which carries the detail and names, and thus will facilitate the use of the series for special maps showing distributions and special classes of information. For instance, the two southern sheets will be used for a more detailed map of Roman Britain than the one on the 1/1,000,000 scale which was published last year. The Roman information will be incorporated on new black plates, which will be used with the Water and Contour plates instead of the present outline. The 10-mile map is being drawn on blue prints of the ¼-inch sheets.

When designing new editions of the small-scale maps it is necessary to keep constantly before one the variety of uses to which they will be put. On each scale as much detail as is possible of all classes is shown, and after military necessities have been met the balance between the civilian claims must be kept—the motorist, pedestrian, engineer, administrator, archæologist, each naturally prefers a map which emphasizes the particular features which interest him; but a National Survey must act impartially and give that prominence to each object represented which its relative importance warrants, and thus indicate its true relation to its surroundings.

It is for the specialist who requires certain data to be emphasized at the expense of the general topography of the country to use the national maps as a basis and to draw or overprint upon them the specialized information he requires. The geological maps of the country are produced in this way, and are the most striking examples of the use of overprinting. Recently this device has been used extensively for administrative, scientific, and other purposes. The ½-inch series prepared and printed by the Survey for the Ministry of Transport is a good example. The outline of the regular Ordnance Survey ½-inch series is used without contours or any relief colouring, and the roads and road numbers are overprinted boldly in red and green, thus adapting a general topographical map to the specialized use of the motorist and of the various administrative bodies responsible for the roads of the country.

The Ministry of Health has recently carried out a very complete survey of the water resources of England and Wales based on the Ordnance

Survey maps. Through the courtesy of Mr. Sandford Fawcett, the Chief Engineer, who conceived and directed the survey, I am able to show a set of specimens of the maps which have been prepared. The information relating to Water and Water Supply is strongly emphasized. The data are classified and each feature indicated by a symbol and numbered, and the country divided according to catchment areas. The system of references to a card-index makes the whole scheme very complete.

A series of maps on varying scales is used, the smaller scales giving a general view of the water resources of the country and at the same time serving as index diagrams to the larger more detailed maps. By means of these maps and the card-index the record of the complicated mass of information relating to the water supply of the whole country is made simple, and reference to any particular object is easy. The system is one which can be studied with advantage by every one interested in practical map work.

Many Ordnance Survey maps showing archæological distributions have also been published; and although much has already been done, there are practically unlimited possibilities for the development of the use of the maps in this way.

To sum up, the aim of the Survey is to give as true and detailed a picture of the country as the scale of each of the maps permits, to improve the cartographic style and legibility of the sheets, to adapt their traditional character to modern methods of reproduction without sacrificing their æsthetic qualities, and above all to secure the degree of scientific accuracy which is required at the present day.

A LITTLE PROBLEM OF THE ARCTIC

ON 12 August 1924, while the Canadian Government ship *Arctic* was at Pim Island in Smith Sound, lat. 78° 45′, a curious discovery was made by Dr. Livingstone, of the North-West Territories Branch, Department of the Interior, Ottawa. Near the north-western extremity of the island, some half-mile inland, he picked up a case of leather bearing the Royal Crown and cipher V.R.I. in gold.

The Director of the Natural Resources Intelligence Service has been at great trouble to elucidate the question, How did this piece of leather and ornament, evidently forming part of a present from her late Majesty, come to be on Pim Island? He has concluded that it was lost there by one of the officers of the Nares Expedition of 1875, and to verify this conclusion has sent a carefully prepared memorandum, with sketch-map, and the photograph here reproduced, to the five surviving officers of the Expedition, of whom one, Admiral Sir George Egerton, has very kindly communicated it to us.

The memorandum, after setting out the facts of the discovery, arrives at the following conclusion :

" This relic is a spectacle case dropped by one of the 22 officers serving in the *Alert* and *Discovery* on the Nares Arctic exploration expedition sent by Her Majesty's Government in 1875 in an effort to reach the North Pole. It was a gift from Her Majesty Queen Victoria when the ships left Portsmouth Dockyard on May 29, 1875, and was lost between the dates July 30 and August 4, 1875."

The evidence for this very definite conclusion as set out in the Canadian memorandum may be summarized thus : It is a spectacle case from its size and shape. Had it been a pouch attached to a belt, the belt would have been picked up also. The leather piece, on which the monogram V.R.I. is very securely fastened by rivets, is the flap of the case.

The *Alert* and *Discovery* were the only vessels of H.M. Navy which landed parties on Pim Island, of which Cape Sabine is the eastern extremity, during the reign of Queen Victoria. The *Valorous* did not proceed beyond Disco Island. The *Pandora*, in 1876, failed to reach Cape Sabine. Captain Inglefield's furthest north in 1852 had been 78° 28′.

That Queen Victoria made such gifts to explorers is shown by the snuff-box set in diamonds presented to Stanley, with the cipher V.R. surmounted by a crown. In ' The Great Frozen Sea ' (p. 6), Admiral Markham says, " We received many useful and valuable gifts," and " Her Majesty and the members of the Royal Family testified in a substantial manner the deep interest they took in the enterprise."

Now Queen Victoria was not *Imperatrix* until the Royal Titles Act was passed in 1876, the year of Nares' return. But it is improbable that a British officer who had received later a gift from Queen Victoria would have parted with it to a member of the Norwegian, American, or Danish expeditions that have been from time to time on Pim Island. In spite of the difficulty about the cipher, therefore, the Canadian memorandum maintains that the thing was dropped on Pim Island by an officer of the Nares Expedition between 30 July and 4 August 1875. Early in the morning of the former day the two ships anchored in Payer Harbour, 2 miles south of Cape Sabine. A depôt of rations was placed on an islet, a cairn was built on the summit of the highest, and " the ships were detained for three days watching for any opening in the sea. . . . Early in the morning of Aug. 4 the main pack moved off. . . . Sail was immediately made " (Official Report, pp. 8–10). On the return voyage the ships did not call at Cape Sabine.

The spot at which the relic was found could be easily reached by land along the east and north shores of Pim Island, which are mostly low and flat. Had the party continued west and south from this point, they would have found that Cape Sabine was on an island and not on the mainland of Ellesmere Island, as Nares' map shows it. But the western shore is precipitous.

REMAINS OF LEATHER POUCH WITH CROWN AND ROYAL CIPHER IN GOLD, FOUND ON PIM ISLAND BY Dr. LIVINGSTONE, 1924

This is the substance of the Canadian memorandum. It raises a small problem of which the solution is not easy. Admiral Sir George Egerton tells us that his first impressions on reading the memorandum were :

(1) That the leather case was not a spectacle case.

(2) That it had never belonged to any officer in the Nares Expedition of 1875.

(3) That H.M. Queen Victoria would not have made a gift with a monogram in gold to which she was not at that time entitled.

He has ascertained that the firm of goldsmiths who used to mount monograms and crests for the Queen has been out of business for more than twenty years ; but that the firm of opticians who made most of the glasses and cases are of opinion that V.R I. was mounted in 1874. On the other hand, the Keeper of H.M. Privy Purse cannot believe that such a present was given to one of the officers of the *Alert* or *Discovery*, since it is most improbable that Queen Victoria would have made a gift carrying an emblem to which she was not at the time entitled. Sir Frederick Ponsonby has examined Her late Majesty's private accounts, so far as they exist, and can find no trace of any such gift. He suggests, however, that a foreign officer serving in London as Naval Attaché might possibly have received such a gift on vacating his appointment. He is informed by the Admiralty that the piece of leather could never have formed part of a naval uniform.

Since this curious problem was communicated to us by Admiral Sir George Egerton we have made various inquiries without result. And because the Director of the Natural Resources Intelligence Service in his covering letter invites criticism of his memorandum and suggestions for a solution, we are glad to assist him by giving the problem publicity.

What can this leather pouch have been? A recent letter from the Director gives its size as $5\frac{1}{2}$ inches long by 3 inches wide and $1\frac{1}{2}$ inches thick. That does not look like a case for spectacles, though perhaps for snow-goggles, to whose use the memorandum makes reference.

Did any officers of Nares' ships have an opportunity of going so far from Payer Harbour : about 6 miles as the crow flies and some 10 miles by the coast? We can see from the above report that Sir George Nares was anxious to get away : he was " detained three days watching for an opening," during which time no parties could be ashore and far away. It seems that if it were one of Nares' officers he must have gone straight ashore on July 30, walked 10 miles to the other extremity of the island, lost his field glasses or spectacle case, or whatever it was, and been back at least by the evening of the 31st—a possible but not altogether a likely programme, especially when we remember that they did not after all recognize the place as an island.

The pattern of the relic and the circumstances of the visit combine to make it most unlikely that the first judgment of the Canadian memo-

randum is correct. We have then an ample field for inquiry, and shall welcome information on the following matters: Is there in existence any leather case with the Royal and Imperial cipher of Queen Victoria which one might suppose reduced to the condition of the fragment represented here after fifty years' exposure in the Arctic? Is there any evidence of the use of this cipher V.R.I. before the end of 1876? Is there knowledge of any visit to this north-western extremity of Pim Island before Dr. Livingstone went there in 1924? Several expeditions have been at Pim Island. The Kane Basin detachment of the R.C.M. have now a post across Rice Strait on Ellesmere Land; but have they been on Pim Island? Is the place visited by Eskimo who might have picked up the relic elsewhere and lost it again? Replies to these questions might assist the solution of this curious little problem of the Arctic.

A GREAT ORIENTAL LIBRARY

IT is not merely the student world of Japan but all students of things Oriental that owe a deep debt of gratitude to Baron Hisaya Iwasaki, through whose munificence and public spirit the famous Morrison Library, with many notable additions, has been so splendidly housed and placed at the disposal of all engaged in research work connected with Asiatic countries and affairs, more especially those dealing with the Far East. This Tōyō Bunko, "Oriental Library," is of so unique a character that it deserves some special notice in the columns of the *Geographical Journal*.

The building in which it is so worthily housed is situated in Kami-Fujimachi, Komagome, Hongo-ku, Tokyo, and was formally opened on 28 November 1924. It is of reinforced concrete in two sections of three and four stories respectively, and is fireproof, with a handsome facing of warm-brown brick.

The Morrison Library, which forms the nucleus of the whole, represents twenty years of patient research and wisely directed effort on the part of the late Dr. George Ernest Morrison, formerly *The Times* Correspondent in Peking, and later Adviser to the Government of the Chinese Republic, whose almost unique position gave him entirely exceptional opportunities of acquiring works on China to an extent, variety, and value that subsequently made the collection the envy and admiration of all Orientalists and Sinologues who have had the privilege of access to it.

It was purchased from Dr. Morrison by Baron Iwasaki in 1917 for a sum of £35,000, and originally comprised some 24,000 volumes, exclusive of about 1000 maps and printed pictures. Among the wealth of pamphlets, which number over 6000, are many important documents which Dr. Morrison was able to acquire only by virtue of his position as Adviser to the Chinese Government and correspondent of *The Times*.

The books deal with subjects of every imaginable kind relating to China, Korea, Manchuria, Mongolia, Siberia, Chinese Turkistan, Russian Central Asia, Tibet, Cochin-China, the East Indies, and the Philippines, and practically all the languages of Europe are represented, not excluding Turkish, Arabic, and Hebrew.

Notable among the works included are over forty editions of the Travels of Marco Polo, beginning with the earliest Latin edition, published in Antwerp, it is supposed, in 1485.* The library is specially rich in the literary labours and reports of some of the earlier European missionaries in seventeenth-century China. There are no fewer than 500 dictionaries of the languages and dialects of the Chinese Empire, 500 books on the Russo-Japanese War, together with a large collection of works on natural history, especially on the birds of China. Particular care appears to have been taken in the acquisition of publications of all kinds dealing with modern geographical and archæological exploration in Asia, of which the collection is almost exhaustive.

The library is extraordinarily rich in maps, through whose comprehensiveness can be traced the Western knowledge of Eastern geography, together with the results of the work of the scientific surveys lately achieved by Western cartographers.

The printed pictures are chiefly portraits of Europeans and Americans whose names are most prominently associated with the Far East.

The Morrison Library has itself passed through stirring adventures in its time. In the Boxer Rebellion of 1900 its owner's home was destroyed by fire, but the library itself was saved almost miraculously, for it had been removed to a place of safety in the nick of time. Escaping from fire, it was next threatened with destruction by water shortly after Baron Iwasaki had purchased it in 1917 and temporarily housed it in the *kura* (storehouses) attached to his home in the Fukagawa district of Tokyo. In the autumn of that year Fukagawa was partly devastated by a so-called "tidal wave" which followed in the wake of a frightful typhoon. The newly purchased treasure was for the most part under water, and the submerged cases containing it were still unpacked. With characteristic energy Baron Iwasaki sought out the best expert assistance in the restoration of the books damaged, and by dint of immense patience and skill almost everything was completely restored. During the earthquake fires of September 1923, which reduced to ashes many other libraries in Tokyo, notably that of the Imperial University, towards the replacement of which some effort was lately made in this country, this unique and irreplaceable treasure-store fortunately escaped damage. It is little to be wondered at that some strange spell making for security and safety is believed to have been woven round the collection.

* The actual first edition was, strangely enough, in German, being printed at Nürnberg in 1477 and again in 1479. The Antwerp Latin edition is assigned to 1485 on the evidence of the type.

Special interest will be felt by many Fellows of this Society in learning that among the valuable works preserved, besides those already mentioned, are such as the early vocabulary of Mentzel, published in 1685, in which that writer gives a Latin equivalent of the characters of the Nestorian alphabet; the MS. dictionary completed in 1724 by Fernandez Serrano; the MS. dictionary used by Sir John Barrow, attached to the Macartney Embassy in China in 1793; and a complete list of Turkish books on Islam, presented to Dr. Morrison by the American traveller, the late Mr. W. W. Rockhill, successively United States Minister in China, Russia, and Turkey.

Among the works in English may also be mentioned Goldsmith's 'Citizen of the World,' in its rare first edition of 1762; and a first edition (1719) of Defoe's 'Second Voyage of Robinson Crusoe,' in which that wanderer travels to Peking through the Gobi Desert and Siberia. Perhaps one of the rarest features of the Morrison Library is the complete set in French, Italian, and Latin of all the controversial pamphlets written at the time of the famous dispute between the Dominicans and the Jesuits relating to ancestral worship in China during the early part of the eighteenth century.

In concluding these notes on this great collection the fact should, however, be emphasized that the Tōyō Bunko is not merely the Morrison Library under another name. To it have been added no fewer than 25,000 volumes bound in European style, and 20,000 in Japanese, so that the original library has been more than doubled in size. These new additions include also many photographs of books and documents unearthed by Sir Aurel Stein and Pelliot in Western China, together with photographic copies of some of the rarer publications of the Jesuit Mission Press in Japan.

The total cost of this gift of Baron Iwasaki to the nation, including the additions and the premises built to receive the treasures, amounts to something over £150,000.

For much of the above information the writer has to thank his friend Dr. Eisaku Waseda. W. W.

REVIEWS

EUROPE

Plant Life on East Anglian Heaths, being Observational and Experimental Studies of the Vegetation of Breckland.— **E. Pickworth Farrow.** Cambridge University Press. 1925. 10 × 7½, pp. x. + 106. *Twenty-three Plates containing forty-six Photographs, and ten Figures in the text.* 7*s.* 6*d.*

BRECKLAND, the flat sandy area in south-west Norfolk and north-west Suffolk overlying the chalk and abutting on the Fens, probably owes its origin to the spreading of wind-blown sand bordering the Wash when this estuarine complex extended much further southward than it does to-day.

For a long period it must have been a favourite home of early man, for flint implements of various ages are found in great abundance, and there are also prehistoric earthworks. What the immediately post-glacial vegetation was we do not know, but there is some evidence that it may have been steppe during a continental climatic phase, for Breckland has the distinction of possessing several species of plants of central and eastern European distribution, and not found elsewhere in Great Britain. However this may be, the country has never been very suitable for agriculture, and is now mainly heathland, largely used as rabbit warren. Apart from the shallow valleys there are no trees except those in fairly recent plantations. A good part of the area is covered with the common ling, but this alternates with other plant communities, especially bracken, sand sedge, and a community known as "grass-heath," of which the main constituents are the common bent (*Agrostis tenuis*) and the sheep's fescue (*Festuca ovina*).

The author set out to investigate the causes of this curious mosaic of vegetation. He found that the rabbits are progressively killing the heather, which is replaced by the grass-heath. This is eaten very short but can survive severe rabbit attack. The sand sedge spreads over the heath from certain centres, but is eaten by the rabbits when they are very much pressed for food. The bracken is not eaten at all, or is only occasionally nibbled. It was probably introduced with planted trees, as it is found especially spreading from plantations. This it does by means of its underground rhizomes, but it also colonizes fresh areas by means of wind-borne spores which germinate in the relatively damp conditions of rabbit burrows. Thus the species mentioned are resistant to rabbit attack in the following ascending order: ling, bent and sheeps' fescue, sand sedge, bracken; and in the long run the victory is necessarily to the bracken, but at present the struggle is still proceeding.

The most interesting feature of Dr. Farrow's work is the excellent use he makes of simple experiments, such as fencing small areas from rabbits, and irrigating some of these by means of a cask of water arranged to drip constantly on the ground. His results, which include studies of the relation to water, of competition between species, and of the effect of blowing sand, are striking and entirely convincing, though his views as to the past history of the area are more open to question. The book is illustrated by a series of excellent photographs which bring the changes that are proceeding in the vegetation vividly before the reader. A. G. T.

Shropshire Place-names.— **E. W. Bowcock.** With a Prefatory Note by **Allen Mawer, M.A.** Shrewsbury: Wilding & Son. 1923. $7\frac{1}{2} \times 5$, pp. 271. 8*s.* 6*d. net.*

It is fortunate that the English Place-name Society has been able to enlist the services of the author of this excellent little book, which admittedly is not final. It is written in the right way with due regard to early forms and the opinions of earlier writers. (A few of these latter might have been omitted with advantage.) We note with interest that a Celtic river-name *Cunet occurs in Cound (Cuneet, Coneta); the form Cunetio, which is connected with the name of the Wessex river Kennet, occurs, however, in the Antonine Itineraries (at Marlborough). Hawkstone (p. 118) probably retains its original meaning; isolated stones elsewhere bear the same (possibly legendary) name. The river Roden (p. 196) has been connected with the unidentified Rutunium of the Itineraries; but the early forms of Roden do not throw any light on the matter. Sambrook (p. 204) is, we think from the early forms given, more likely to be connected with an old river-name Sem—or Semene—than with

Sand. Mr. Bowcock's remarks on Shrewsbury and Salop are interesting and convincing. We hope his book will have the success it deserves, both locally and amongst students of place-names in general. O. G. S. C.

The Long Barrows of the Cotswolds.— **O. G. S. Crawford, B.A., F.S.A.,** Archæology Officer, Ordnance Survey. Gloucester: John Bellows. 1925. 10 × 7, pp. xv. + 246. *Illustrations and a Map.* 25*s. net.*

IN this well-printed, well-illustrated, and altogether pleasant volume, Mr. Crawford describes the long barrows, stone circles, and other megalithic remains in the area covered by Sheet 8 of the ¼-inch Ordnance Survey, comprising the Cotswolds and Welsh Marches. The work serves admirably as an introduction to the distribution, purpose, age, structure, folklore, etc., of these objects; while plans and photographic illustrations and a copy of Sheet 8 (third edition) smooth the way of the reader.

Previous to the Iron Age in Britain, a barrow burial-place was a large mound, long-shaped, circular, or oval, and of these the long barrow is generally accepted as the most ancient, being mainly Neolithic, and containing, at any rate in Yorkshire, long-headed subjects exclusively. Such a mound—often called a "Low," especially in Yorkshire—was usually placed in a conspicuous position, especially on an elevated summit. An interment was sometimes of calcined remains of a cremated body, sometimes of unburnt bones. Primary burials are found in the centre of the floor of the mound, but later burials in the same mound are common. The body (or bodies) was protected either by a stone chamber, with access by passage and portal, or by a completely sealed cist. When the body was burnt, the ashes were often placed in a covered urn; but the buried body was wrapped in a garment fastened by pins and buttons which have often been found. Personal ornaments in the shape of necklaces, beads, brooches, and stone or bronze weapons and tools (especially the leaf-shaped dagger of bronze, flint arrow-heads, and stone or bronze axes) were buried with the body. There were also fire-baked pots and drinking-cups or beakers with a good deal of ornamentation. These burial practices extended over many centuries during the Neolithic and Early Bronze Ages. Such are the inferences drawn from the very numerous excavations of barrows made during the first three-quarters of the nineteenth century in North Yorkshire, Derbyshire, and Staffordshire, especially by the Batemans, father and son.

Substantially the same is the picture to be drawn from the long barrows in the Cotswolds, the Welsh Marches, and elsewhere now carefully recorded by Mr. Crawford. He tells us that leaf-shaped (though not the barbed and tanged) flint arrow-heads have in several instances been found associated with primary interments in these western long barrows. He notes the general parallel between the limestone moors of Derbyshire and Staffordshire and the Cotswolds, both regions of "relatively dense population, both in the late Neolithic and the succeeding Bronze Age." However, in the Cotswolds there is an almost complete absence of stone axes and of beakers, of flint daggers and of copper blades, a difference the author admits to be hard of explanation. Is it due to want of excavation, or unmethodical excavation? The Cotswold barrows, however, follow the rule in being often placed, like Belas Knap, on the edge of valleys, sometimes on or near the centre of a high ridge. Mr. Crawford's view is that "the bones deposited in the burial chambers had already been buried or exposed for a time elsewhere, and were subsequently dug up and collected for solemn re-burial in a permanent and more imposing resting-place." For in the majority of cases "complete skeletons have not been found, but the incomplete remains of several skeletons." Similar secondary

burials are recorded in Italy and Sicily. Not only is there re-burial, but the bones have been intentionally broken up in accordance, possibly, with some ritual. This theory, though it explains many of the facts, is a hard one. Who would see to this unpleasant business, and at what interval of time? Was it only the great who were subjected to this unnecessary disturbance? As to the age of the Cotswold primary interments, the most reasonable hypothesis is that they belong to the late Neolithic period. "No metal object has ever been found," but leaf-shaped flint arrow-heads and the very scanty remains of pottery are confirmation of this dating. Long barrows may have continued to be made in the Cotswolds during the Aeneolithic Period; for while, generally speaking, long barrows have chambers and round barrows cists, in Brecknockshire cists occur in Ty-isaf, Pen-y-Wyslod, and other long barrows, and in Gloucestershire, at Cow Common, a chamber was found in a round barrow, the others in the row being certainly of the Bronze Age.

Such are some of the interesting points dealt with in Mr. Crawford's cautious introduction. The pages (26–43) on folklore connected with long barrows and stone circles, including a lengthy quotation from Sir Arthur Evans on the folklore of Rollright, make stimulating though (perhaps because) inconclusive reading. The author, who has probably visited and described more barrows, stone circles, and standing stones than any other archæologist of this generation, can speak with unusual authority on their present condition. "The present state of the Long Barrows," he writes, "is deplorable; and the future state of most of them will be more so, unless measures are at once taken to preserve them. . . . Only one really satisfactory method has been devised—an unclimbable iron railing." Careless excavation, cold-blooded breaking up and removal of stones, and the wickedness of trippers have wrought irreparable damage, and the motor car will surely hasten the process. Readers of this book, which will no doubt become a standard one for the subject, cannot fail to be grateful to its author for his painstaking, reverential record; and will best repay him by at once seeing to it that the oldest structures we possess are protected. We agree that Lodge Park and Cold Aston, the only two perfect long barrows in Gloucestershire, should be kept intact, even from archæologists. Let each reader bestir himself in his (or her) own district.

The Place-names of Buckinghamshire.— **A. Mawer** and **F. F. M. Stenton.** (English Place-names Society, vol. **2**.) Cambridge: University Press. 1925. 9 × 5¾, pp. xxxii. + 274. *Two Maps.* 18*s. net.*

This is the first county volume published by the English Place-names Society, and its execution and interest augur well for the success of the series. It is now surely unnecessary to urge the value of a scientific investigation of place-names for any attempt to interpret the "palimpsest" of the English countryside. Buckinghamshire as a shire is a comparatively recent creation, it possesses little unity, and its history has not been striking, yet this survey assists in bringing out several points of interest. It shows that the northern portion, more thickly populated though more wooded, was probably settled by Angles from the Ouse, and later experienced strong Scandinavian influence; in the south the influence of the Middle Saxons pushing into the Thames valley is apparent; while between the two lie the Chilterns, scantily peopled. Chiltern itself is pre-English, and the presence here of names of Celtic origin, such as Chalfont, indicate the existence of a British population after the reduction of neighbouring areas. In the later names, the personal element largely predominates: Buckingham itself is the "hamm of Bucc's people." Some topographical elements appear in combination with them, as in Olney,

"Olla's island," and Lavendon, "Lafa's valley." The nature of the northern area is shown by certain derivations; for example, Bletchley—"Blaecca's clearing." A more purely descriptive use is found in Risborough, interpreted as "brush-covered hills." No explanation is given of Icknield Way, on which so much inconclusive speculation has been indulged in, the earliest form, recorded from the year 903, being Icenhylte. Further volumes, with the light they may be expected to shed on local problems, will be awaited with interest.

The Last Age of Roman Britain.— Edward Foord. London: George G. Harrap & Co. 1925. 8½ × 5½, pp. 294. *15s. net.*

Mr. Foord is to be congratulated on his gallant attempt to make a coherent sketch of the history of Roman Britain during its last centuries. His enterprise might seem almost a forlorn hope, so scanty is the documentary evidence, and so comparatively scanty the results of archæological research. If more light is ever to be shed on the subject, it seems likely that it can only come from the glint of the well-used spade. The method of this book is admirable. Two principles are rightly emphasized: an absolutely independent investigation and estimate of the primary authorities, and a determination to treat Roman Britain as a part of the Roman Empire as a whole. Mr. Foord's conclusion is that Roman Britain was separated from the empire in the decade 440–450 A.D., and in this he finds himself in agreement with Prof. Bury and in opposition to Mr. Collingwood's "(apparently) confident opinions." From the geographical standpoint, several maps and plans in the book are of interest, notably one (p. 162) illustrating the distribution of the British defensive forces about 428 A.D., and another (p. 244) showing the division of Britain about 500 A.D. between its various occupants. Attention may be called also to a bird's-eye view of Richborough and Thanet in the fifth century, from a drawing by Major Gordon Home. The sketch-map (p. 82) of the points of attack of the assailants of Britain from the fourth to the sixth century is also a useful piece of apparatus. The writer's opinion is that the first English settlement in Yorkshire was made about 425–430, and that the first seven battles of Arthurus mentioned in 'Historia Brittonum' (cap. 50) were fought in the region of the river Dunglass and the defile of Cockburnspath, which was so prominent in the Dunbar campaign of Cromwell. The mysterious tribe of Attacotti who joined the assailants of Britain at the end of the fourth century are conjectured to be Irish from the Dublin region (Ath-Cliath).

Behold the Hebrides! or, Wayfaring in the Western Isles.— Alasdair A. MacGregor. London: W. & R. Chambers, Ltd. [1925.] 7½ × 5, pp. xvi. + 248. *Illustrations. 7s. 6d. net.*

This collection of papers on the scenery, history, and traditions of the Western Isles combines patriotic enthusiasm, a love of the open air, and a poetic temperament. Though of unequal quality, some appearing to be too ephemeral for inclusion, they are simply and effectively written, but occasionally marred by a self-conscious air. Their value is probably greatest as a record of rapidly passing customs. The appearance of the book is spoilt by the use of a very heavy-faced type for the text.

The Basques and their Country.— P. S. Ormond. Privately published. 1925. 7½ × 5, pp. 143. *Photographs and Sketch-map. 2s. 6d.* (at The Lantern Bookshop, 103, Fulham Road, S.W.3.)

In this booklet there is a good deal of desultory information about the history and customs of the Basques (mainly of the French Basques), but not very much

about their country. So that, while there is something here for those who care to ramble in an uncritical spirit along historical by-paths, there is for the geographer very little except some gleanings from a short section on Architecture (pp. 78–85), illustrated by Plates I., V., and VI. This is a pity, because Mr. Osmond's photographs are excellent, and he has adopted the excellent practice of intensifying illustration without prejudice to economy by showing some thirty snapshots on eight plates. One feels that he might have done a good deal to vivify our rather vague ideas of a not very well-known region, just as he has illuminated the equally little-known game of *pelota*. But he ought in the future to avoid references such as that on page 2 to " The barren basin of the Ebro which actually seems to kill the vegetation along its banks." To the human geographer this appears an unseemly levity exhibited on the very threshold of a classic region of canal irrigation.

He would have been better advised also to regard the problem of the origin of the Basques as outside the scope of a work of this kind. R. A.

ASIA

Fifty Years in China. The Story of the Baptist Mission in Shantung, Shansi, and Shensi, 1875–1925.— E. W. Burt, M.A. London: The Carey Press. [1925.] 7 × 4½, pp. 127. *Illustrations.* 2*s. net.*

The interest and the value of this modest little volume of 120 odd pages are by no means to be measured by its size. Much of the matter, more especially in the earlier chapters, is exceedingly timely in view of present conditions in that distracted country. In the account of the intercourse between the mission workers and the student and merchant classes in the inland towns much light is thrown on the mentality of people far removed from the centres of foreign trade at the seaports and larger cities primarily affected by the present outbursts of hostility—directed mainly, it is to be noted, against the British community as a whole. The work of the Society with whose activities the volume is primarily concerned, is rightly viewed as an integral component in the age-long impact of Christian intercourse upon China, and the book therefore begins with a useful outline of the successive stages by which Western religious activity has been brought to bear on China from quite early times—a story well known to students of Chinese history, but less so to the general reader. It may suffice to recall here that the existence of Christians in China in his time is mentioned by the Christian historian Arnobius, who wrote before 300 A.D.; that the results of the Nestorian activities are recorded by the famous monument still standing at Si-an-fu; that the devoted and energetic John of Montecorvino, though already fifty years old when he reached China about 1292, succeeded during his thirty years of labour there in translating the Psalms and Gospels into Chinese, and is said to have himself baptized 30,000 converts; and that a new period of zealous missionary work by a devoted band of Jesuits was ushered in towards the close of the sixteenth century by the arrival of that remarkable man, Matteo Ricci, who by his gracious personality, culture, and scientific attainments found almost equal favour with the Imperial Court and the common people. In each of these episodes the teachers were welcomed, and their efforts for a time crowned with considerable success: in each case, sooner or later, their converts were almost extirpated by ruthless persecution.

The modern chapters of the story open with a brief note on the arrival of Robert Morrison in 1807, to begin work under the auspices of the London Missionary Society. For many years he was refused admission to China

proper, and settled in Macao. There, as translator to the "Honourable East India Company," he produced a Chinese dictionary which was published by the Company at a cost of £15,000. Morrison also translated the Bible into Chinese, though he was able to accomplish but little direct evangelistic work, and died in 1834. It was for others to enter into the fruits of his labours.

This is not the place for a detailed account of the work of Christian propaganda carried on by the Baptist Missionary Society since its operations were initiated in 1875 by Dr. Timothy Richard. But mention should be made of the extraordinary part played by him as leader of relief work during the "Great Famine" of 1877, principally in the province of Shansi. Not only did it evoke the gratitude of the people affected, but in an official Consular despatch to the Foreign Office, it was remarked of Richard and his colleagues that any one who had seen the lives they were leading must be proud of being able to claim them as countrymen.

The writer of a recent leading article in the *Times* remarked, apropos of the slaughter of 2000 Chinese villagers in Fukien because some of their number had ambushed the party sent by a local bandit leader to collect the illegal opium tax, "The Boxer spirit slumbers, but is by no means dead." In this book, chapter xi., a vivid account is given of the inception of the "Boxer" movement as the sequel to the murder in 1898 of two German missionaries in Shantung, and the punishment of the governor of that province at the demand of the German Minister. The whole of the English members of the Baptist Mission in Shantung, together with their families, were murdered in cold blood, a fate shared by large numbers of British and other missionaries elsewhere. W. W.

Cambodge et Cambodgiens : Metamorphose du Royaume Khmer par une Methode Française de Protectorat.— Paul Collard. Paris : Société d'Editions Géographiques, Maritimes et Coloniales. 1925. 10 × 8, pp. x. + 312. *Numerous Illustrations and a Map. Frs.* 40.

This comprehensive and important work is a companion to Colonel Maurice Abadie's 'Les Races du Haut-Tonkin' (reviewed in the *Journal* of February 1925), and has the laudable object of making the French public better acquainted with "la plus intéressante de nos possessions de l'Indo-Chine." This M. Collard is as well qualified to do as any man living, for he has had twenty-seven years' administrative experience in the rich country fertilized by the Mekong, which he aptly describes as "le Nil Cambodgien." After an historical outline, he deals with ancient Khmêr literature and annals, and with various aspects of the life of the Cambodians, whose distinctive characteristic is, he tells us, passivity : in a land where the lakes and rivers teem with fish, and where rice grows almost without cultivation, owing to the marvellous fertility of the yearly flooded soil, it is not strange that they should be unambitious. They are a race which has remained exceptionally pure, a race with a splendid past. "Des ruines . . . voilà tout ce qui resterait, sans Angkor-Vat, de la grande passée des Khmêrs." But he believes that under French protection they have before them a splendid future, and his main purpose is to show what French Colonial Administration has done for Cambodia since the Convention between the two countries was signed in 1884. He himself has seen a patient and tractable people freed from the oppression and misgovernment of its former rulers, and the main part of his work is to show how the butterfly is emerging from its chrysalis, assisted by French Colonial officers. His account is necessarily a partial one, but to support his contention that the present *régime* is a success he quotes Lord Northcliffe's remark (a characteristic

one) that " La colonisation française doit être saluée chapeau bas." The book is excellently illustrated, but its value would have been enhanced by the addition of an index. O. R.

AFRICA

The Lost Oases.— A. M. Hassanein Bey, with an Introduction by **Sir Rennell Rodd.** London: Thornton Butterworth. 1925. 9 × 6, pp. 316. *Illustrations and Sketch-map.* 21*s. net.*

Hassanein Bey's account of the feat for which this Society awarded him a Gold Medal is not only among the most arresting, convincing, and readable of travel books, but unique in its kind. Its subtle singularity comes of the blend of East and West in its author. If ever those "twain" have met, it is in this travel book, the first written in the English of Balliol by an Arab of cosmopolitan experience and culture, who remains a fervent Moslem and a mystic. It is a curious experience to follow him—to watch him sitting for weeks in calm contemplation by the tomb of the Grand Senussi at Jaghbub; then faring afoot from Jalo to Kufra, so possessed by the desert man's utter dependence on God that ultimate fate is a matter of indifference. The while he thinks fondly on the baked meats of smart restaurants in London, Paris, Milan, makes a compass traverse, and each night refills his camera and takes half a dozen observations of Polaris. Profoundly fatalistic, Hassanein keeps an unsleeping eye on the guide's direction, and corrects him tactfully when he has walked in a circle and meets the night breeze though he had started down-wind; he shepherds and drives his caravan, doctors men and animals, chips off geological specimens, arranges to halt where rock-carvings are, and in general is as conscientious an explorer and recorder as any matter-of-fact Briton who believes in nothing but himself and wholeheartedly despises mysticism, if he happens to know what it is.

That Hassanein is an Arab, a Moslem, and a mystic proved as essential to his success as that he is a man of prompt action, of Western science, and of cosmopolitan curiosity. It is clear that no one, who had not the first three of these qualifications, would have been allowed to push on beyond Kufra; while no one, who had not the other three, would have coveted and attained to the discovery of the oases and the passage of that painful and hardly travelled track to Darfur. Even towards such a man as Hassanein Kufra was not too frankly friendly—perhaps it found him as difficult to understand as we; but, beyond a doubt, towards any Christian or even any less well-accredited Moslem wishing to explore roads which might impair the contemplative peace of the Senussi Retreat, the murmurs that were heard behind Hassanein's back would have been replaced by active and virulent hostility face to face. For Kufra to-day knows no economic ambition, or indeed secular ambition of any sort. If it ever was a station on a trade-route, that day has passed with the development of easier passages for Central African products by railway and waterway. That economic importance of situation on which Hassanein's first companion on the Kufra road insisted, he now shows to be null. Nor is this the only point on which Hassanein, speaking for himself, corrects Hassanein as interpreted by Rosita Forbes.

His title 'The Lost Oases,' has been chosen, doubtless, for its popular appeal to the common craving for the mysterious; but in the body of the book itself, the author writes soberly enough about those two just habitable tracts of blistered hill and valley, with their lack of trees, their bad well-water and scanty rain-pools, their sparse vegetation and the few black families that contrive to support a starved existence. Were it not for the utter vacancy and death of vast tracts all about them, they would hardly be distinguished by that name

oasis, with its connotation of palm groves and irrigation and settled agricultural and pastoral folk. Arkenu and Owenat could hardly serve any economic purpose, were there an economic purpose to be served by the track upon which they lie. But they might serve, as Hassanein suggests, an administrative end. The first lies just within the uttermost south-western corner of Egyptian territory, the second just within the uttermost north-western angle of the Sudan. Police posts in each might bring those lost corners under real control. But, then, what in them is worth controlling? To judge by Hassanein's account of the relief and the surfaces over which he reached the oases, an approach from the north—from Sollum—by motor transport would seem not impracticable; but hardly from the south. Of more direct routes from the east—from any part of the Nile Valley—nothing is yet known. If a track is ever travelled from Dakhla to Kufra—a track which must entail sixteen continuous camel days without a chance of replenishing water-skins—it would encounter dune-country too heavy for any car to penetrate. But there may be a more practicable motor route from Halfa, if the unknown eastern part of the Owenat hill system prove not too extensive and broken, and if water can be found anywhere in the interval to supply one or more stations for petrol storage.

The discovery of these oases was both an interesting and a useful achievement. There had long been curiosity about them on the Egyptian and on the French side; and now we know exactly what and where they are. But neither the supreme merit of Hassanein's journey nor the main interest of his book lies in their discovery. His capital contribution to geographical science is his correction of the position of the Kufra oases. In what consists the chief value of his narrative has already been said. It remains only to point out that, eminently readable as this book is, it is no mere popular account. The author has put into its pages the results of much scientific work; and valuable appendices contributed by Mr. John Ball give in detail the data from which those results were obtained. Some admirable photographic views enhance the attractiveness of a book which, to our mind, ranks very high in its class, and indeed, so far as desert-lore is concerned, among the very first. It almost realizes a hardly possible ideal—that a Beduin should write of Beduins. At any rate Hassanein comes nearer to them than any previous traveller of his calibre, and when he speaks of them and interprets them, he carries conviction. So too when he speaks of the Senussiyah; for of this he has made a special study under singularly favourable conditions. D. G. H.

The Vegetation and Soils of Africa.— **H. L. Shantz** and **C. F. Marbut.** New York: American Geographical Society. Research Series No. 13. 1923. $8\frac{1}{2} \times 5\frac{1}{4}$, pp. x. + 263. *Illustrations and Maps.* $5.

Although this book is divided into two main parts: The Vegetation of Africa by Dr. Shantz, and the Soils of Africa by Dr. Marbut, the first part, which embraces only eighty-four pages, really contains the summary of the investigations. Twenty-eight pages are devoted to a bibliography, one hundred and nine pages contain a discussion on soil science generally and the soils of Africa in particular, whilst the remainder deal with the land classification of Africa.

The work of which this book is the outcome was begun in 1918 at the instigation of the "Inquiry"—the technical advisers who prepared data for the American Commission to negotiate Peace. The authors bring to their task a personal knowledge of Africa derived from a journey undertaken from south to north, and also they have consulted every important published work

bearing on the economic possibilities of this country. The resulting summary which is an indication of the agricultural products and possibilities of Africa is in an altogether novel form so far as that continent is concerned. Instead of mentioning the products and possibilities country by country, the authors have appreciated the general natural physiognomic divisions of the vegetation which are based on climatic limiting factors, and have used these as their units for discussion. Thus Forest is divided into eight types, the Grassland into nine types, and the Desert into four types. Each of these types is discussed in detail; a general description is followed by a brief botanical description of the vegetation, then a note on the distribution of the type of vegetation in Africa, the climatic conditions which control it, the soil conditions associated with it, its natural economic productivity, and finally its agricultural uses and possibilities. Copious references to authorities are given with each subject, and between the two parts of the book is included a most useful bibliography of African botanical, agricultural, and general economic literature.

Dr. Marbut's discussion on soil-science generally is followed by his *résumé* of the distribution and nature of the chief soils of Africa. His sources of information are not so extensive as those available to Dr. Shantz, and critics with a detailed knowledge of any particular area may consider his summaries a little too speculative. This may appear so more especially in regard to the last chapter, which classifies the lands of Africa according to their potential productivity, and treats of the soil in a manner somewhat similar to the treatment accorded to the vegetation in the first part of the book.

Apart from the informative and well-reproduced illustrations which accompany each type described, two coloured maps are contained in a separate pocket. One graphically shows the distribution of the types of vegetation enumerated, and as an inset bears a soil map of Africa; the other indicates the land-classification of Africa as discussed in the last chapter, and is accompanied by an inset of a rainfall map.

It is indeed to be regretted that the authors did not see their way to publishing the information accumulated as a series of volumes dealing with the subjects and areas in detail, so making available in one work the material they have now been able but to indicate. The present book would quite well have formed a general summary to the series, which would have provided an admirable work of reference to African vegetation, agriculture, and forestry.

As it is, the authors are certainly to be congratulated on the originality of their treatment of so immense a subject and on the presentation of their information in a form so accessible for reference. Hitherto there was no general up-to-date and yet concise reference work dealing with the agricultural economics of Africa. They have summarized existing information, indicated where any particular subject may be studied in detail, and provided a new base from which further studies may originate. Such summaries are of considerable value in correlating the scattered publications dealing with similar problems in different political areas, but within the same natural boundaries.

T. F. C.

"Hos Ørkenens Sønner," Olufsens Sahara-Expedition, 1922–1923.— H. Hagerups Forlag, København. 1924. $9\frac{1}{2} \times 6\frac{1}{2}$, pp. 212. *Illustrations and Sketch-maps.*

In 1922 Hr. O. Olufsen, who had already travelled in Asia and Africa, made up a party, including a Danish botanist and a French geologist, to carry out further investigations in the hinterland of Algeria. Landing at Tunis, they travelled through Tuggurt, Warqla, and In Salah to the mountains of

Hoggar, or Ahaggar, and from the French fort at Tamanrasset returned by a more westerly route to Beni Unif and Algiers. Herr Olufsen has written a very interesting account of the journey, the deserts, sandy and stony, the irrigation and cultures, and the various peoples he encountered. His description of the Tuareg and Haratins of Hoggar, with whom he came into close contact, is particularly full. Numerous illustrations of the country and people add to the value of the book.

The scientific results, topographical, meteorological, geological, anthropological, etc., will be published later.

AMERICA

Ancient Warriors of the North Pacific: The Haidas, their Laws, Customs, and Legends, with some Historical Account of the Queen Charlotte Islands.— Charles Harrison, F.R.A.I. London: H. F. & G. Witherby. 1925. 9 × 6, pp. 222. *Illustrations and a Map.* 15*s. net.*

The Queen Charlotte group, part of the persistent ridge which runs parallel to the western coast of Canada, comprises some two hundred islands, of which the most important are Graham and Moresby, although even these have not been explored thoroughly. Mr. Charles Harrison reached Massett, now the principal port at the northern end of Graham Island, in 1883, making the journey from the mainland with his wife in a canoe 35 feet long. A gale sprang up halfway across, all the baggage had to be jettisoned to keep the craft afloat, and it was only after five days' battling with the sea that the party reached port in an exhausted condition. The Hudson Bay Company's agent was then the only European at Massett, which to-day has a population of at least one thousand Europeans and Japanese, and for forty years Mr. Harrison remained in the islands, devoting his life to converting the native inhabitants to Christianity.

These Indians are known as the Haidaṣ, but they call themselves the Ou Hāādē—the Inlet People. Although they were formerly the most powerful and warlike nation on the Pacific coast, it is only within comparatively recent years that serious attempts have been made to study their customs or characteristics, or even their gī-hangs, the remarkable carved crest poles they set up outside their houses. Mr. Harrison appears to be ignorant of the elaborate monograph on the Haidas given by Mr. Stanton in the fifth volume of the Publications of the Jesup North Pacific Expedition, based on ten months' stay in the islands (1900–1901) for the study of their religious ideas, social organization, and language; for he makes no reference to this in the list of literature to which he has been indebted for information. But his own comprehensive work on this fast-vanishing tribe is welcome because he is so well fitted to write it, for by reason of his long residence among them he probably knows more of the Haidas than any living man. Through his knowledge of their language he has been able to obtain a vast amount of information regarding their customs, traditions, and social organization direct from the principal chiefs, men who at the time were from sixty to eighty years old. He has brought to his task quick observation, well-balanced judgment, and sympathy; he avoids theories and generalities; he is content to record. The result is a book of some value, which is enhanced by useful chapters on the geography, geology, resources, flora and fauna, and early history of the island. The work is well illustrated (though more pictures of Haida types might have been included), and is accompanied by an index and an adequate map.

O. R.

Handbook of Alaska : its Resources, Products, and Attractions.— Major-General A. W. Greely. Third edition. New York: Charles Scribner's Sons. 1925. 8 × 6, pp. x. + 330. *Illustrations and Maps.* 15*s. net.*

Alaska : An Empire in the Making.— John J. Underwood. London : John Lane. 1925. 8½ × 5½, pp. xvi. + 440. *Illustrations and a Map.* 12*s.* 6*d. net.*

The appearance of revised editions of these two works is evidence of the growing interest that is being taken in Alaska. Both naturally cover much the same ground, but there is considerable difference in treatment. Mr. Underwood is prone to outbursts of enthusiasm which cause him to refer to Alaska as the " spoiled child of Nature," " no cradle for the puny nursling," and so forth. It also leads him into vagueness as to which part of the vast area he is referring to ; generally, of course it is south of the Arctic Circle, and frequently the coastal regions. General Greely gives a more matter-of-fact account, but from both the same conclusions are to be drawn. The basis of Alaskan prosperity is its mineral wealth : its development is hindered by high transport charges, which are nearly fatal to its agriculture and timber industries. Until the mineral wealth is being fully utilized, or overcrowding in more accessible regions forces an influx, it will not be within sight of its maximum population. As a region for the tourist it is probably unsurpassed.

Brazil after a Century of Independence.— Herman G. James. New York : The Macmillan Company. 1925. 8½ × 6, pp. xii. + 587. *Illustrations and Maps.* 17*s. net.*

The handbook of Mr. James has been compiled, he tells us, from a mass of information published in Portuguese in Brazil during the Centenary celebrations of 1922 ; and it is issued with the object of giving the compiler's compatriots in the United States added interest in the huge States that make up the Brazilian Union.

Somewhat handicapped by its form and purpose, the book not unnaturally suffers from the stodginess of the translated Government report ; the reader who wants statistics of area and populations will find them, and trade figures likewise, but innumerable pages are so perfunctory in their information that it is difficult to believe that the author has ever set foot in so exhilarating a country as Brazil. The maps are inadequate and the illustrations are the poorest the reviewer has ever seen of this land of beauty. L. E. E.

Colombia, Land of Miracles.— Blair Niles. London : John Long, Ltd. 1925. 8½ × 5½, pp. 387. *Illustrations.* 18*s. net.*

When Mrs. Niles restrains her somewhat sentimental muse and merely depicts impressions of travel in Colombia her pages become much more readable than when she attempts to resurrect sixteenth-century worthies in imaginary conversation. The result is, in the latter case, wearisome ; and the learning of the authoress is insufficient to redeem her preoccupation in the creation of a romantic atmosphere.

The best part of the volume is that devoted to a hydroplane journey up the Magdalena River to Bogotá ; but Mrs. Niles traversed only a small part, and upon beaten tracks, of the great republic of Colombia ; no new aspects or enlarged presentment of the country are provided. Nevertheless the book is graceful and kindly, and Mrs. Niles rarely mis-spells Spanish words. The photographs are new and excellent. L. E. E.

AUSTRALASIA AND PACIFIC ISLANDS.

Among Papuan Headhunters.— E. Baxter Riley. London: Seeley, Service & Co., Ltd. 1925. 8½ × 5½, pp. 316. *Fifty Illustrations and Two Maps.* 21*s. net.*

Mr. Baxter Riley has had some twenty years' experience of the Kiwai, who are the best-known natives of Western Papua, and so is well qualified to write of them. Presumably his experience has been gained in the capacity of missionary, but of his own labours Mr. Riley tells us nothing; he is concerned with giving a graphic and comprehensive account of the Kiwai's customs, manners, magic rites, ceremonies, and social life. The tribe is not confined to Kiwai Island in the estuary of the Fly River, for the term Kiwai now includes the natives living on both banks of the river for a distance of 30 miles from the mouth and those residing in the coast villages from Goaribari Island to the Dutch border, though Mr. Riley himself includes only the coastal villages extending 40 miles to the west. Hitherto little has been written about the Kiwai, though travellers have noted their extremely melancholy disposition, and Mr. W. R. Humphries in his 'Patrolling in Papua' spoke highly of the Kiwai police he had. Mr. Riley himself has no illusions about the Kiwai, although obviously he is in sympathy with them and so has come to understand them. He sees them as "energetic, industrious, shy, suspicious, revengeful, and very vindictive. They never forgive an injury until the account has been squared." Forty years ago they were fierce headhunters, and even now headhunting has not ceased in the higher regions of the river. Only a few of the old Kiwai headhunters remain, and Mr. Riley has been fortunate to procure from them a detailed account of the headhunting customs and the ceremonial connected with raiding; in addition to this, his description of the elaborate and terrifying initiation ceremonies, through which every Kiwai youth had to pass, is most valuable, since the facts have been given him by those who have passed through all the orders of the craft. The book is intended to make a popular appeal, and such it undoubtedly has, for it is a readable and interesting account of a primitive and little-known people; but it will be also of considerable importance to anthropologists, since Mr. Riley writes with authority and, without generalizing, gives those minute details which are of scientific value.

O. R.

POLAR REGIONS

Beschryvinghe van der Samoyeden Landt en Histoire du Pays nommé Spitsberge.— Hessel Gerritsz. Uitgegeven door S. P. L'Honoré Naber. 'S-Gravenhage: Martinus Nijhoff. 1924. 10 × 6½, pp. lix. + 126.

Hessel Gerritsz was born at Assum, near Beverwijk, in the year 1581, and, after being employed in the business of W. J. Blaeu, opened a bookshop in Amsterdam about the year 1612. Here, in 1612 and 1613, the publications collected in this volume were issued, the first being a description of the land of the Samoyedes by Isaac Massa, a native of Haarlem, who spent eight years in Moscow, returning to his own country in 1609. Following the description is a short account of the roads and rivers by which the Muscovites travelled to the east and north-east. Both Massa and Gerritsz regarded this information as of importance in relation to the passage to China, and the latter contributed a preface in which he treated of the north-eastern and north-western passages to the Pacific. The other composition, the history of Spitsbergen, was probably called forth by the action of British whalers, who drove off whalers of other nations from the waters of Spitsbergen. It consists of the story of the discovery, chiefly from Barents' log-book, a description of the country, a protest against

the English monopoly, and a note by Plancius showing that Willoughby Land could not have been Spitsbergen. Besides these works there are two other papers which attracted much attention at the time, before fuller reports had been issued—a short narrative of Hudson's last voyage, begun in 1610, and a memoir presented by De Quiros to the King of Spain on "Australia incognita" (De Quiros named the southern continent he believed he had discovered after the House of Austria), translated by Gerritsz probably from the first edition printed in Seville in 1610.

Mr. Naber contributes a long introduction on the different editions of these works and the sources from which Gerritsz's information was derived, and elucidates the text by numerous notes. He has devoted to this volume the same labour and painstaking care as to the others he has edited for the Linschoten-Vereeniging. He also notices the other geographical works of Gerritsz, who died in 1632.

The map illustrating Hudson's last voyage is curious in that, though no doubt of English origin, it was not published in England. Mr. Naber believes that Gerritsz obtained it through Plancius. It is reproduced in Asher's 'Henry Hudson' (Hakluyt Society, 1860). Massa's map of northern Russia and the land of the Samoyedes, drawn from a Russian sketch, is taken from the Latin edition of 1613. In its earlier form (1612) it is given in Beke's translation of De Veer's narrative (Hakluyt Society, 1853). A map of the world in two hemispheres shows the Solomon islands connected with the southern continent of De Quiros. Lastly there is a map of the Arctic north of Europe, in which Spitsbergen is drawn from Daniel's map of 1612, the original of which is unknown. There is a copy, however, according to Asher, in the 'Begin ende Voortgangh van de Nederlantsche Oostindische Compagnie,' part 1, p. 13. Amsterdam, 1646. W. A. T.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

Die Kartenwissenschaft.— Max Eckert. Zweiter Band. Berlin and Leipzig: Walter de Gruyter & Co. 1925. 10½ × 8, pp. 812.

The first volume (1921) was reviewed in September, 1923. In this second volume the author pursues his subject, as happy in it as a modern Herodotus. The first section (125 pages) is devoted to Hydrography. Treating cartography as a whole, one should of course include hydrography, but it is as rare as it is welcome to find it so included. History (interesting), characteristics and compilation of charts are followed by a discussion of Mercator's and Gnomonic projections, and before passing on the author considers special maps of currents, winds, temperature, ice, biology, fisheries, and trade routes.

In the second part we get the "special purpose" map, the field for the principal labours of the geographer. In opening the subject the author begins by discussing the cartographic record of numbers and statistics. There follow fifty-six pages on ethnographic and population maps in all sorts of combinations, climatic, geological, etc. Then we come to those maps of trades, resources, commerce, and physical features in which the average value is the main point of importance.

Part III. is a *résumé* of all maps of the inorganic world. These, in fact, are the cartographic illustration of geophysics. The most important section is that on the design, colouring, etc., of geological maps.

Part IV. is the mapping of the organic world. Botanical, zoological, ethnological, medical, political, historical, etc., maps are all to be found described in 87 pages. Commerce and Communications get another 143 pages. There

is a great deal of value here for the preparation and design of wall maps, and those at atlas scales.

Part VI. is of more value to the professional cartographer than to the geographer. It deals with the æsthetic and logical side of mapping. The general introduction of photo-mechanical reproduction of coloured maps has brought a number of problems in its train: hypsometric layer schemes, for example. The search for the best method of amplifying contours in showing relief is another point. It is curious that the author does not discuss the real difficulty of evolving a type and size of lettering which shall retain the pleasant effect of hand engraving whilst showing up in sufficient contrast to modern colouring. A map which retains the fine minute black detail of the past is almost unreadable when covered with red roads, brown contours, blue streams, etc.

Lastly the author discusses war mapping, its special characteristics and methods, and the lessons (for example, the value of a grid) which it has made evident. There seems to the reviewer no reason why any one person should be able to judge fairly of the difficulties, successes, or failures of the geographical work of his erstwhile foes. Eckert is candidly annoyed with criticism directed at the German "Kriegsvermessungswesen"; but he falls into many errors himself. For example, our 1/100,000 map of the Western Front was not, of course, on a cylindrical projection; we had, equally of course, as many small-scale strategical maps as any one else, in spite of a national "lack of the capacity and elasticity so desirable in scientific cartography," and we really did have more than 150 kilometres of war mapping to do!

Indeed, a general warning seems necessary. Like Jordan's 'Vermessungskunde,' these two volumes embrace the whole of the subject included by their title. But Jordan is so widely used because he gives the facts of the case and little which is controversial. 'Kartenwissenschaft,' on the other hand, though robust and usually well informed in its opinions, is very often controversial, and often coloured by a natural but unfortunate national bias. The facts are sometimes wrong, too.

Consider projections. So long as a topographical projection secures sensible accuracy of representation its merits or demerits rest wholly upon its simplicity of construction. There is then no need to decry the polyconic and less to object to Lallemand's modification which has made the projection of the International 1/M map a practically accurate representation.

Again, so far from sticking wholly to hand engraving in her wealth and conservatism, it is twenty years since England began seriously on photo-mechanical methods. Again, if it was our development and wealth which were the natural causes of our unique series of published, and revised, 1/2,500 plans and not the energy and foresight of our mappers, then equally it was the mountainous landscape which led to photogrammetric development in Southern Germany, Austria, and Switzerland, and not any particular scientific pre-eminence in those South German gentlemen whose pioneer work is of such value to us all to-day.

If a certain lack of impartiality is characteristic, however, the book remains unique in its scope and will be found of great value to all geographers who are directly or indirectly concerned in cartographic record. The volumes are unwieldy in size and, as is usual with foreign books, are sent out unbound but the letterpress printing is good. H. S. L. W.

GENERAL

Les Conditions Géographiques de la Guerre.— Captain Robert Villate. Paris: Payot. 1925. 10 × 6½, pp. 350. 35 *francs.*

It stands to reason that a soldier must think seriously of geography. No one has to react more quickly to his environment than he. It stands equally to reason that he is dependent upon weather and upon soil. But for all that he does not as a rule talk of geography, geology, or meteorology. To the ordinary soldier indeed these factors, "the nature of the country" and the weather, are bound up with others—the enemy and comparative armament. Every manual is, in its way, a text-book on military topography, and so is every military history. One may start off bravely "arma virumque cano," but one must perforce become as interested as Sir Walter Scott in the landscape before long.

No military book can, however, afford to separate out the art of war into its various aspects too minutely. Every natural obstacle can be overcome or avoided by itself. Its importance at the moment is dependent upon the disposition of the enemy. This is the text on which Captain Villate writes. He does not like "une nomenclature fastidieuse," and sets himself to discuss what influence the conditions of nature actually had on the strategy and tactics of individual operations of the last war. He naturally finds that influence everywhere, but he shows how in many cases operations did not follow the obvious geographical solution. The other factors were sometimes too strong.

Captain Villate writes like a soldier for soldiers, differently therefore from D. W. Johnson, in 'The Battlefields of the World War.' He comes to much the same conclusions, of course, but in soberer vein. In his investigations he takes each item in turn. The subsoil, elevations, rivers, villages, woods, industrial development, weather conditions, etc., and explains how they affected the actions of certain units in certain battles, but he never forgets the man and his armament. His book should have a considerable audience amongst soldiers in England. It is extremely sound and extremely moderate. Indeed, it would be a valuable study for any staff officer.

The author is particularly convincing when he talks of military education in geography. In France there seems to have been the same tendency, as in England, to treat geography as an end in itself, and to confuse the young idea with synclines, thalwegs, and map-reading out of a book. Instruction must of course be practical and if a cadet could map Hill 60 and manœuvre a platoon on it, he could readily grasp the importance of Vimy Ridge, and of the Vosges, for the matter of that. The influence of mud, of a bitter head wind and driving rain, he will learn soon enough without courses of geology and meteorology, though later on he must understand the effect of these factors on gas and ballistics, tanks and sound-ranging.

It is a pity that the maps and diagrams are only poorly reproduced, and indeed drawn, but the letterpress is good and clear. H. S. L. W.

The Empire at War.— Edited for the Royal Colonial Institute by **Sir Charles Lucas, K.C.B.** 4 volumes. London: Humphrey Milford; Oxford University Press. 1921–24. 9 × 6. Vol. 1, xi. + 324; vol. 2, x. + 508; vol. 3, x. + 430; vol. 4, x. + 620. *Maps, Diagrams, and Illustrations. Price* (vol. 1) 15*s.*; (vol. 2) 25*s.*; (vol. 3) 21*s.*; (vol. 4) 28*s.*, *all net.*

The volumes so far published in this comprehensive work initiated by the Royal Colonial Institute, deal with the war contributions of Africa, Australasia, Canada, and the American colonies. A further volume describing the part played by India and the Eastern units will complete the series. The work is

well produced, the illustrations (chiefly of Imperial statesmen and leaders) being particularly lavish, thanks to the generosity of the Rhodes trustees. It is hardly necessary to enlarge upon the need for such a record or its general interest, not least to geographers. In the first volume, Sir Charles Lucas, from his profound knowledge of Imperial history, briefly traces the growth of co-operation, not only in military preparation but in the underlying ideals, and outlines the condition of the Empire at the outbreak of war. In each succeeding volume, the Commonwealth is displayed under the testing of events. The mass of detail on the fortunes of the military and naval forces of the Dominions and Protectorates, on their internal political developments and the measure of their contributions to loans and funds, is never allowed to become burdensome or meaningless. In every chapter the special characteristics of each country and their consequences are clearly discernible from the typical African campaigns of small forces and great distances, with the obstacles of tropical forests and creeks to be overcome, to the large-scale campaigns in France. Every important event finds its place: there is even an account of the miniature naval war on Lake Tanganyika. An example of Imperial co-operation is furnished in the assistance rendered by the Union of South Africa, during the period of food shortage, to Saint Helena. In conception and execution these volumes are certainly worthy of the subject they treat.

John Cary: Engraver, Map, Chart and Print-Seller, and Globe-Maker, 1754 to 1835.— Sir Herbert George Fordham. Cambridge: University Press. 1925. 9 × 7, pp. xxxiv. + 140. 10*s.* 6*d. net.*

In this volume Sir George Fordham ascribes to John Cary the chief share in raising English cartography of the eighteenth century to a standard comparable to that attained by contemporary map-makers on the Continent. Certainly Cary was fortunate in the time of his cartographical activities. The remarkable advance in foreign and especially in French cartography, as exhibited in the maps of Delisle and d'Anville, and in the magnificent Carte Topographique de la France in 180 sheets, begun by César François Cassini de Thury (1714–1784) and completed by his son, Jean Dominique (1748–1845), had established models which inspired not only Cary, but also Aaron Arrowsmith and other English map-makers as well, with the desire to achieve a greater accuracy and beauty of design in their work, for which, owing to the progress of discovery and exploration, and to the development of internal communications and the consequent increase in road and canal traffic, there was growing up an ever-increasing demand.

The extent of John Cary's cartographical output and the claim that he should be recognized as one of the foremost cartographers of his time are thus summarized by Sir George Fordham:

"The national canal-construction movement and the development of rapid stage-coach and post-chaise traffic on our roads bring Cary to the front as an engraver of maps and plans, and as a publisher of itineraries and road-books, and as responsible for an extensive measurement of distances on the principal public roads of the country, while the preparation, engraving and publication by him of the geological maps, sections, and descriptions of William Smith connect him with one of the founders of a great science."

We might add that Cary was also noteworthy as the producer of numerous globes, both terrestrial and celestial, varying in diameter from 21 to 3½ inches. Sir George Fordham's statement, however, that "Globes once so essential in polite education . . . are now little used" is not correct; the fact being that

globes, produced by newer and cheaper processes, have become a standard article of geographical equipment in schools throughout the country.

The nature of John Cary's contribution to eighteenth-century cartography was brought to the notice of geographers last year in the representative collection of the publications issued by himself and his successors, brought together by Sir George Fordham and exhibited at the Society's House. In the volume under review Sir George has erected a more permanent memorial to one of the most noteworthy exponents of the older school of English cartography.

The bulk of the book is taken up with a chronological catalogue of the works issued by the Cary Press, accompanied by a classified index arranged under subjects and giving the dates of original editions and all known reprints. Both in its arrangement and in the short critical descriptions attached to each entry, it is a model of systematic bibliography, which might well be followed generally by those concerned with the cataloguing of such documents. We regret, however, that it contains no particulars of the numerous terrestrial and celestial globes published from 1791 onwards by the Press.

The Introduction describes the life and geographical activities of John Cary and his successors. Of John Cary himself little is known. He was born about 1754 and died in 1835, at the age of eighty-one. He started as a journeyman engraver, and appears to have commenced publishing for himself about 1784, the year in which he issued his Survey of the Post Road between London and Falmouth, for which Aaron Arrowsmith furnished the pedometer measurements. In about 1821 John Cary appears to have transferred the control of his business to his sons George and John, and in 1850 it ceased to exist, the stock of plates being taken over by Cruchley, who somewhere about 1876 disposed of them to Messrs. Gall and Inglis.

Among the more noteworthy publications issued by John Cary and his two sons may be mentioned:

'The New and Correct English Atlas' (1787), containing 46 large quarto maps of the English Counties. The 'New English Atlas' (1809)—a folio county atlas. 'The Universal Atlas of the Principal States and Kingdoms throughout the World' (1808), with 55 large folio maps. William Smith's 'Delineation of the Strata in England and Wales' (1815), a geological map in 15 sheets, scale 5 miles to the inch. William Smith's 'Geological Atlas of England and Wales' (1819–24), a geologically coloured edition of the New English Atlas. 'The New Itinerary, an Actual Admeasurement made by Command of His Majesty's Postmaster-General of the Roads of Great Britain' —the best known of Cary's publications, of which 11 large editions were produced between 1798 and 1828. 'A Map of England and Wales, with part of Scotland' (1794), in 81 sheets, scale 5 miles to the inch—the first known English map on which the meridian of Greenwich is substituted for that of London; and a reduction of this map published in 1796 on the scale of 15 miles to the inch. 'Terrestrial and Celestial Globes,' 21 and 12 inches in diameter (from 1791). G. P.

An Introduction to Economic Geography.— W. D. Jones and D. S. Whittlesey. Vol. 1. University of Chicago Press. 1925. 9 × 6, pp. xxxviii. + 375. *Maps, Diagrams, and Illustrations.* $5.

The authors of this book present a method of teaching economic geography which has been used for ten years in the University of Chicago. The present volume deals with natural environment in its bearing on man's economic life. A second volume will be devoted to the major economic activities as related to the natural environment. It is claimed that between them the two volumes

will "establish the fundamental principles of the science." There is no suggestion of text-book or treatise in the volume, which consists of a series of classified exercises on the different geographical factors. These are to be worked by the student by reference to maps and the second and third parts of the book, which consist of "textual materials" in the form of paragraphs on specific topics—some original, others taken from standard works—and a large collection of 366 well-chosen maps, diagrams, and illustrations. It is only in this manner that the book can be usefully employed, for although there is a full index the textual materials are not very comprehensive in scope, and, as in most American books, refer mainly to American geography. The matter, as far as it goes, is accurate and well presented, and the exercises are cleverly conceived, but there are gaps in the treatment. As supplementary to a systematic course of lectures the volume should be useful. It helps the student to think for himself, and it avoids mere memorizing. The authors insist on the liberal use of large-scale maps and the value of field excursions. R. N. R. B.

Religion, Commerce, Liberty, 1683–1793.— **J. W. Jeudwine.** London: Longmans, Green & Co. 1925. 9 × 6, pp. xxxiv. + 391. *Sketch-maps.* 10*s.* 6*d. net.*

Religion and liberty are not characteristics one would expect to find assigned to Western Europe in the eighteenth century. Commercial expansion was a mainspring of international action throughout. Mr. Jeudwine seeks to show that "no Empire and no supremacy in trade can ever be permanent without the support of Religion and Liberty," so that he is at least able to draw many warnings from the history he relates. Much of the book is devoted to the American revolt and the growth of the British Empire. He has evidently read widely, and has decided opinions of his own, so that his pages are not dull. There seems occasionally to be lacking a sense of proportion, and failure to perceive motives underlying events. England, for example, certainly got something out of her wars with Louis XIV., and not perhaps at too heavy a cost.

A Geographical Introduction to History.— **Lucien Febvre.** London: Kegan Paul. 1925. 9½ × 6, pp. xxv. + 388. *Diagrams.* 16*s. net.*

This volume in the 'History of Civilization' series is a translation of a work, 'La Terre et l'évolution humaine,' already reviewed in the *Journal* (vol. 60, p. 308). As there appear to be no changes in the text, it is unnecessary to add to the opinions expressed by the former reviewer. In this form the comparative sparseness of references to works in English is more noticeable. The translation might be better, though one is not continually reminded that the work was originally written in French. Geographers, however, may find some difficulty in tracking the place-name "Transhumance" in the Carpathians.

The Sea, the Ship, and the Sailor: Tales of Adventure from Log Books and Original Narratives. With an Introduction by **Captain Elliot Snow,** Construction Corps, U.S. Navy. Salem, Massachusetts: Marine Research Society. 1925. 9½ × 6½, pp. xviii. + 373. *Thirty-one Illustrations and Two Maps.* $4.50 *net.*

Like the Hakluyt Society, the Marine Research Society of Salem is performing admirable service in bringing to light and publishing authenticated narratives of voyages which would otherwise remain forgotten or unknown. This volume, the seventh of the Society's publications, consists of five narratives and journals of adventurous mariners. Two of these have never been previously published, and are printed from journals recently discovered and now in the

possession of the Peabody Museum, Salem. The first is the journal of John Bartlett's voyage (1790–1793) to the then almost unknown North-West coast of North America and elsewhere; the second is the narrative of Captain John B. Knights, who sailed the Salem brig *Spy* to the South Sea Islands and New Zealand in the years 1832–1834. The remaining narratives are reprints from little-known volumes. Captain Charles H. Barnard's adventures during a voyage round the world between 1812 and 1816, taken from a scarce book published in New York in 1879, includes the account of his life for nearly two years on an uninhabited island of the Falklands, his ship having been seized and himself abandoned by a shipwrecked crew of English seamen he had come to rescue. The adventures of John Nicol during thirty years at sea were originally published at Edinburgh in 1822; but there is no clue to the source of the account of William Mariner's experiences in the Tonga Islands,nor any indication that the two volumes published in London in 1818 have been here condensed to eighty pages. Even partially, however, this narrative, although better known than the others, was well worth reprinting. To those interested in the first coming of Europeans to this part of the Pacific, it may usefully be read with the recent Hakluyt Society's publication 'The Journal of William Lockerby' (reviewed in the *Journal*, October, p. 368), Lockerby having been stranded in the Fijis shortly after Mariner had been taken prisoner on the massacre of the officers and crew of the privateer *Port au Prince* off the Tongas in 1806.

There can be nothing but praise for the appearance of this volume, and the illustrations, mainly taken from old engravings and mezzotints, are beautifully reproduced. It is not clear, however, who is responsible for editing the narratives. We may be permitted to regret that in this respect the book falls short of the best of the Hakluyt Society's publications, in which so admirable a scholarship is brought to bear on the text in the way of annotation. Here only in Bartlett's narrative is there any attempt to elucidate the text; and it is questionable whether the Society's purpose would not have been better served by publishing part of Mariner's narrative unparaphrased. O. R.

The Chambers of Commerce Atlas. Specially prepared for 'The Times' Trade and Engineering Supplement.— Edited by **George Philip** and **T. Swinborne Sheldrake.** London: George Philip & Son, Ltd. 1925. 16 × 11; *text*, pp. xvi. + 56 + 33; *Plates*, pp. 112. *Cloth* £2 12*s.* 6*d. net*; *Half leather*, £3 13*s.* 6*d. net.*

This important work contains a large amount of information which is certain to prove valuable to the student of geography no less than to the man of business, for whom it is primarily intended. It is, indeed, the most comprehensive attempt which has as yet been made, in this country at least, to map the economic activities of man. On one series of plates is shown the distribution of about one hundred important commercial products—vegetable, animal, and mineral; on another there is indicated the present state of economic development in almost all parts of the world. Some maps of a more general nature show the position and relative importance of the main maritime routes, the distribution of water-power, the diplomatic and consular representation of Great Britain and the United States, the world's fairs and exhibitions, and so forth. In addition to the maps, many of them with insets, there are almost innumerable diagrams illustrating the production and foreign trade of every region of economic importance. Accompanying the maps showing the distribution of commodities there are descriptive notes dealing with the conditions under which each commodity is produced. the regions from which it is obtained,

and the uses to which it is put. The whole work concludes with a commercial compendium in which is included a short account of many articles of less importance than those dealt with elsewhere.

From this admittedly inadequate survey it will be apparent that the editors of the Atlas undertook a task of considerable magnitude, and it is hardly surprising that the results are somewhat unequal. Perhaps they have succeeded best with the maps which show the distribution of economic products. These are drawn on a modification of Goode's Homolographic Projection, and have evidently been carefully prepared. The "dot" system which has been used has on the whole worked out well, and some very effective work has been produced. When, however, the dots are so close that the colouring becomes continuous the effect is lost. In most cases, but unfortunately not in all, the difficulty has been overcome by providing inset maps on a larger scale.

The regional maps on which economic activities are indicated are less uniformly satisfactory. In the case of the great industrial countries too much has been attempted. To show the more important place-names of such a region, together with the distribution of its forests and agriculture, its mineral wealth and its industries, on one and the same map is to overload it. For this reason the general maps of England, France, and Central Europe, among others, are difficult to read, and because of their appearance are more likely to repel than to attract the student. On the other hand, where a smaller area is shown on a larger scale, as is, for example, the industrial region of England and Wales, or where economic conditions are relatively simple, as they are in Australia or South Africa, the results can be studied with both pleasure and profit.

When we come to consider what is shown on the maps and not the methods by which it is shown, we are at once compelled to ask whether the attempt to illustrate post-war conditions by an atlas on so elaborate a scale is not as yet premature. The economic world is still in a state of unstable equilibrium, and even when an average of several years is taken statistical data cannot be regarded as representing an approximation to normal conditions. To base all the quantitative maps on the records for a single year, generally 1922, is bound to give even more unsatisfactory results. To take a single instance, in 1922 the Canadian output for wheat was 46 per cent. that for the United States, but in 1923 it was 60 per cent. For some parts of the world, indeed, recent figures have been unobtainable, and it has been found necessary to utilize those for 1913. In the same way many of the diagrams which illustrate foreign trade relate to a single year, and cannot be regarded as possessing more than a passing interest; on the other hand, some based upon figures extending over a series of years, such as those which show the increase in the agricultural and mineral output of Australia and South Africa, are of considerable interest.

The descriptive notes attached to the commodity maps will be found useful, though on the scientific side they are sometimes vague and even misleading, as witness the following statement: "Coal, being a Secondary sedimentary deposit, and not a recent rock or an igneous intrusion (such as metalliferous ores), never has an extensive outcrop." But on the technical and marketing side they contain many interesting pieces of information not usually available to the ordinary student. The commercial compendium at the end of the atlas, also, contains much useful matter, mainly with regard to the less well-known articles of commerce.

On the European maps, some, but not very consistent, attempts have been made to render place-names according to their post-war form. Thus we find

" Budweis (Budejovice)," " Bratislava (Pressburg)," and, on the same plate, " Teschen (Decin) " and " Decin (Teschen)." It may be suggested also that a carefully compiled list of alternative names might have found a place in a work of so comprehensive a nature.

The atlas must be regarded as a courageous attempt to represent the economic activities of man, and that the attempt has not proved altogether successful is to be at least partly attributed to the circumstances of the time in which it has been made. For an atlas of this description there is, however, an important place, and we hope that when economic conditions have become more stable than they now are it will be possible to revise the present work and give it, as far as is possible, a more permanent character. J. McF.

THE MONTHLY RECORD

EUROPE

River-terraces and Glacial Drifts of the Welsh Border.

In a paper contributed to the *Zeitschrift für Gletscherkunde* for June 1925 the Rev. T. L. Pocock of Godington Rectory, Oxfordshire, gives a detailed description of the terraces and drifts in the several river valleys along the Welsh and English border (Dee, Teme, Lugg, Wye, Usk, etc.), bringing out their relation to those of the Severn and Avon discussed by him previously in the same journal, and drawing inferences concerning local conditions during the Pleistocene glaciation. The conclusion is that at the maximum glaciation all the rivers of the Welsh border, except possibly the lower reaches of the Severn and Wye, were overwhelmed with sheets of ice flowing from the Irish Sea and mountains of Central Wales, independently of the present valleys. Remnants of the deposits of this period remain in isolated situations generally at high altitudes, indicating great subsequent denudation. A definite minor stage of glaciation is also indicated in which the motion of the ice was guided by the greater valleys, and with this glaciation are connected the highest river-terraces at 100 feet and upwards in the Severn, Avon, and Dee valleys. The Usk valley separating the South Welsh from the Black Mountains, and close to the local centre of dispersion of the ice, was so completely overwhelmed that regular gravel terraces corresponding to those of the Wye and Severn are absent, the whole length of the valley being now thickly strewn with glacial detritus. Thus by means of detailed comparative study of drift-deposits and fluvio-glacial river terraces Mr. Pocock is enabled to throw considerable light on the past history of a wide area of England and Wales. He thinks it probable that the maximum glaciation in this part of the country was contemporaneous with the Mindel period, the minor stage referred to above with the Riss period, and more local subsequent glaciations in the Welsh valleys with the Würm period. In the Avon valley there are indications of an interglacial temperate-climate fauna.

ASIA

The Highest Mountain in Siam.

We have received a reprint from the *Journal of the Siam Society*, vol. 19, April 1925, describing ascents of the highest mountain in Siam by Messrs. H. B. G. Garrett and A. Kerr. This mountain is usually called Doi Intanon, the name of a neighbouring chief given to it by Mr. J. McCarthy when surveying

this area. It is stated however that it possesses a native name of its own, Doi Angka, and that it is thus known to the surrounding inhabitants. It lies about 35 miles south-west of Chieng-mai, and its altitude is approximately 8500 feet. Though it had already been ascended by Dr. Hosseus, the German botanist, in 1905, and later by Prince Bavardy, their visits were more or less hurried, and the narrative by Messrs. Garrett and Kerr gives further details on a little-known region. Mr. Garrett made his ascent in September 1910. The route he followed lay along the north and south ridge which terminates in the south in a wide ravine, known as Pa Ngem, or forked rock. The first night was spent on the western slopes near this ravine. After cutting a way up the farther side the next day, the party found themselves on a ridge still running south. It was difficult to determine the highest point on it, but at that which was finally selected as likely to be the summit traces of Hosseus' visit were found. After a descent to the camp on the lower slopes, the remainder of the time was spent in collecting. Coral was plentiful on the rock slopes around Pa Ngem. As it was the rainy season, the work was much hindered.

In April and May 1921, Mr Kerr made another journey to the summit. This time the route was from the south-east. It lay at first through an open grassy forest of medium-sized trees, which afterwards passed into a more regular forest of oak and pine. Among the trees flowers were appearing, including orchids. From a small Karen village surrounded by small ricefields, at about 3000 feet, two guides were obtained. The most noticeable plant here was a *Rosa gigantea:* honeysuckle and wild raspberries were also seen. From this point to the summit the mountain was covered with a thick evergreen forest with dense undergrowth, largely bamboo. On the summit of the ridge a marsh was found, which gives its name to the mountain: Angka meaning "Crows' bowl." It contained good drinking-water, and was the source of a mountain stream. Round it were trees (oaks, maple), small shrubs, including two species of rhododendron, and ferns. Small birds were plentiful and very tame. The striking feature of the undergrowth was the bleached, almost white stems of dead shrubs, belonging to a species of *Strobilanthes*, said to flower after seven years and then die. Another visit to the Pa Ngem was paid in July 1922, when further collections were made. Much damage through fire to the fresh growth of abandoned clearings in the forest was noticed.

Changes at the Mouth of the Kur (South-Western Caspian) since 1829.

In a short article printed in *Petermanns Mitteilungen* (71, Heft 9/10), Dr. Büdel traces the changes observable since 1829 at the mouth of the Kur, or Kura, on the south-western shore of the Caspian, on the basis of the Russian large-scale survey-sheets of 1829, 1862, and 1912. According to official figures the Kur has a volume of 250 cubic metres (about 8750 cub. feet) per second even at low water, and the amount of material it brings down from the border of the Armenian highland is enormous, the result being that the shore-line at its mouth is pushed out some 60–100 metres each year. In 1829 the main mouth appears to have entered the sea with no eastward-projecting delta, whereas by 1862 the shore-line had advanced from 3 to 4 kilometres, and the progress has been equally rapid since at the points where the several branches into which the stream is now divided debouch. North of the delta, too, a shallow bay has been entirely filled up so that the shore-line has been displaced some 10 kilometres. Changes of equal magnitude are observable on both the east and west shores of the gulf of Kizil Agach. Dr. Büdel does not explain why the delta should have been pushed out beyond the general shore-line only since 1829, but it could, no doubt, be explained on

the supposition that a diversion of the main stream occurred about that time, by which the principal load of detritus was carried east towards the open sea instead of south towards the gulf of Kizil Agach.

Dutch Exploration in Central Borneo.

An important expedition has been at work in East Central Borneo during the past summer under the leadership of Captain D. W. Buys, with a view to exploring the only important area in the great island still remaining unknown. We have received from the chief of the Royal Survey Department, Batavia, copies of papers describing, firstly, the general plan and organization of the expedition, and secondly, its progress in the field down to the end of June. The undertaking has been promoted by the "Indisch Comité voor Wetenschappelijke Onderzoekingen," formed some years ago for the furtherance of scientific exploration in the Dutch East Indies, which has already much good work to its credit in Ceram and elsewhere. The field chosen lies between the upper course of the Kajan river in the north and the headwaters of streams flowing southwards to the Mahakam, and falls mainly within the administrative subdivision Beraoe. The upland region which gives rise to numberless tributaries of the above great rivers, as well as to the smaller Kelai on the east, has hitherto been quite untouched by white men, lying considerably north and east of the routes of Nieuwenhuis, Molengraaf, and Lumholtz, though its eastern and southern fringes have recently been touched by a military patrol under Lieut. Soeratman and the American Gilbert, as well as by the Dutch geologist Witkamp, who is a member of the present expedition. It was hoped to carry out an accurate survey of as large a part of the area as possible, besides geological, botanical, zoological, and ethnological researches. Under the last-named head a search was to be made for archæological remains from the Hindu period, and also for cave-dwellers of whom some rumours have been heard. After a full consideration of the best line of approach to the unknown area, that by the Telen river, the largest northern tributary of the Mahakam, was decided on, and the first report of progress describes the ascent of this river in canoes under considerable difficulties due to heavy rains and the obstacles caused by the many rapids and the rock-strewn bed of the river. Efficient service had however been rendered by the Daya'k boatmen under the energetic direction of the native chief Beng Wung. By the end of June the party had ascended the Telen almost to its source, and had thus reached the threshold of the unknown area, while various side trips had been carried out by the geologist Witkamp and the botanist Endert, the former of whom had ascended the Wahau, a northern tributary of the Telen, to its source. To the east was a flat or gently undulating massif of eruptive formation, with a series of Tertiary rocks resting against its western edge. West of the river no elevations of importance were seen. Emanations of marsh-gas were observed, but no sign of oil. Above the Wahau the Telen has a winding course through a level plain, with cut-off bends connected with the river only at high water. Here the surface is formed of recent alluvium and sand, but higher up the Tertiary strata come to light in the form of shales, grits, and conglomerates, with beds of lignite interpersed. Further news from the expedition will be awaited with interest.

AFRICA

South African Drought.

Papers on this topic continue to loom large in South African literature, and following on its report of the drought symposium which appeared in

the *South African Journal of Science* for 1923 (*Geogr. Journ.*, 64, p. 264), the same journal in its issue for 1924 recurs to the subject under the title "Desiccation and how to measure it." The author, Dr. J. O. Schonken, refers to the discussion held in 1914 before this Society on the question, "Is the Earth drying up?" and he definitely sides with the opponents of Prof. Gregory's negative conclusions, at least as regards large areas of the globe. Pulsations, he says, between dry and moist conditions have marked the geological ages, and why should not "climatically weak" regions like Central Asia and South Africa be swinging back to arid conditions? Dr. Schonken proposes that the term "siccation" be employed to include "desiccation" (denoting technically, drying up as due to actual decrease of rainfall) and "exsiccation" (signifying drying up due to decrease in the value of the rainfall, proportional to its irregularity and brought about by various agencies, including man). It is possible for even "climatically sound" regions like North-Western Europe with abundant well-distributed rainfall to suffer local exsiccation, a case in point being the London district, which with a steady rainfall is not being subjected to "desiccation," but is nevertheless being "exsiccated" in consequence of the lowering of the ground water-table through the rapid draining away of rain-water from the vast extent of town surface. Whilst desiccation in the restricted sense is in the long run usually the chief factor in siccation processes, and would probably be found to be in operation in South Africa if rainfall records were long enough, this is being far outrun by exsiccation, which in consequence of agencies which have often been discussed is proceeding at an alarming rate in the sub-continent, the rainfall constantly decreasing in economic utility. Dr. Schonken goes on to discuss the rainfall conditions of thirty-one stations in the Union, for the purpose of obtaining some kind of measure of desiccation in the general or non-technical sense, which by general consent is taking place. He obtains a figure called the desiccation index by dividing the number of rainy days in the year at each station reduced to 100 inches of rainfall by a number expressing the variability or irregularity of the rainfall. With the exception of a few "climatically sound" places on the coast like Cape Town, the indices so obtained demonstrate decided deterioration of climate in the last half-century, whilst Bloemfontein and Kimberley show actual progressive decrease in the amount of rain or desiccation in the proposed technical sense. Those interested should study the detail decade by decade at the various stations.

AMERICA

The Californian Continental Shelf.

The nature and origin of the Continental shelf off the Californian coast is discussed by Mr. A. C. Lawson in the *Bulletin of the National Research Council* of the National Academy of Sciences, vol. 8, Pt. 2, April 1924. His work is based on a chart published by the Hydrographic Office of the U.S. Navy, which shows the contours of the shelf, out to the 2000-fathom line, between San Francisco and Descanso Point, Mexico. The data consist of 5000 soundings obtained by American destroyers, using the Sonic Depth Finder. The shelf north of Point Conception is about 50–70 miles wide: south of the Point it widens, being about 168 miles broad off Long Beach. The top lies generally above the 1000-fathom contour, in places above the 500-fathom contour. It may be divided into three sections: the northern, 105 miles, from San Francisco to the axis of Monterey Bay; the middle, 190 miles, from thence to Point Conception; and the southern, 235 miles,

between Point Conception and Point Descanso. Between the shore and the 100-fathom contour, and from the 100-fathom to the 500-fathom contour the shelf widens towards the south; between the 500 and the 1000-fathom contours, it is widest in the north; the belt between 1000 and 2000 fathoms is fairly uniform in width. Except in the northern portion, the bottom of the steep slope is at or below the 2000-fathom contour. There are no islands of importance in the middle section, nor evidence of considerable volcanic accumulation. From profiles of the shelf and coast ranges, it is apparent that the only slopes on the shelf analogous to the ranges occur on its steep outer-front, and here the resemblance is not pronounced.

The southern section is much wider and its front is steeper. There are several islands and signs of displacement of volcanic rocks. A special feature is the number of closed basins in the shelf, similar to Death Valley basin. The front itself has an average slope of 13·7°. The depression of Santa Barbara Channel terminates westward in a pronounced embayment in the front of the shelf. South of the Channel, the islands of Santa Cruz, Santa Rosa, and San Miguel represent a range of partially submerged mountains, which ends in a headland on the front of the slope. These features and others, including the width and comparative shallowness of the shelf, are evidence that this is a foundering region. Were Southern California to be submerged, its submarine relief would resemble that of the Channel. The northern section makes a sharp change of direction at Monterey Bay: the intersection of the two segments is directly related to the relief of the Bay. At the head of the open syncline there is a delta built up by Quaternary drainage, the top of which is now well above sea-level and much dissected. The extreme northern portion is related to the Golden Gate. Opposite it a bar has been built on the shelf, causing the 100-fathom contour to recede considerably from the shore. The brink of the shelf lies here at about the 100-fathom, occasionally the 500-fathom, contour, but, unlike the other sections, the slope ends downwards at 1500 fathoms, followed by a broad slope to the 2000-fathom contour. Mr. Lawson seeks to explain this shelf from isostatic adjustments following upon the formation of the Coast Ranges by the shortening of the Earth's periphery, and their subsequent denudation. The isostatic compensation would in the first place be spread laterally, forming plateaux. It is then argued that denudation would tend actually to increase the height of the ranges and decrease that of the plateaux. This would be accompanied by faulting along the line of junction, which would explain the nature of the coast-line. The southern section is probably a sinking area, and the shelf finds a counterpart in the Great Valley east of the Coast Ranges.

Early "Americana."

Two reports of American libraries contain some interesting notes on historical and geographical works recently added to their shelves. Perhaps the most important are several Drake items acquired by the John Carter Brown Library, Providence, R.I. These are four contemporary tracts in French and Italian describing his adventures and death. Three of these bear the name of Bernardino Beccari, who may have merely been a compiler or translator, and were published at Rome in 1596. Their short titles are 'Relatione del Svccesso dell' Armata d'Inghliterra, Condotta da Francesco Drac . . . a S. Giouanni di Porto Ricco, 1595'; 'Avviso del Svccesso dell' Armata Inglese Nel voler tentare l'impressa di Panama nel Peru'; and 'Avviso della morte di Francesco Drac, & del mal successo dell' armata

Inglese, poiche parti dal Nome di Dio.' Of the fourth, 'Brief Discovrs tovchant le Svcces des Entreprinses Nagveres attemptez par les Anglois en Espaigne, & Portugal,' 1589, there is a copy in the British Museum, but is said not to have been recognized previously as a Drake item. Other acquisitions are the translation of Waghenaer's 'Spieghel der Zeevaerdt' by Anthony Ashley, entitled the 'Mariner's Mirrour,' 1588; the third edition of Alfonso Veracruz's 'Physica Speculatio,' Salamanca, 1569, which contains a list of towns on the Atlantic and Pacific coasts of North America with latitudes, distances, etc.; and Robert Cushman's 'Sermon preached at Plimmoth in New England, Dec. 9, 1621,' the earliest account of the experiences of the colonists. The William L. Clements Library, Ann Arbor, Michigan, of which some details were recently given in the *Journal* (63, p. 539), has secured a number of editions and issues of various parts of De Bry's Voyages, which makes its set very complete. Other rare works are 'A brief relation of the Discovery and Plantation of New England,' London, 1622; 'A Perfect Description of Virginia,' London, 1649; and Daniel Denton's 'Brief description of New York,' London, 1670, the first account of that city published in English.

Earth-movements during the Katmai Eruption.

In two papers printed in the *Journal of Geology*, vol. 33, Nos. 2 and 3, 1925, Mr. Clarence M. Fenner discusses at considerable length the Earth-movements which accompanied the eruption of Mount Katmai, Alaska, in 1912, some of them of a character not often observed in such a connection. The field studies which supplied the data for the discussion were made by him in the summers of 1919 and 1923. It is impossible here to give a detailed account of the observations or the arguments based upon them, but the general conclusions may be briefly noted. The main question to be answered is whether the movements should be classed as volcanic earthquakes, due directly to the volcanic disturbances, or whether they had a deep-seated origin and should therefore be considered tectonic earthquakes. If the movements were purely volcanic, shocks as severe as those felt at considerable distances from Katmai at the time of the eruption should have been of extreme violence in the region immediately adjacent to the epicentre, but the observations on the spot gave no evidence that such was the case, for the masses of loosely hanging rocks remaining several years later should easily have been thrown down by such severe movements. On the other hand, the records of seismographic stations show that tectonic earthquakes were registered over the whole northern hemisphere at the time of the eruption, with epicentres more or less close to the Katmai region: and it is therefore held to be probable that the eruption was accompanied by tectonic movements. A study of the fissures and faults produced by the outburst in the Valley of the Ten Thousand Smokes shows that while very abundant over the valley floor they are in the main restricted to this depression. Since the fissures formed vents for the extrusion of the pyroclastic tuff that formed the sandflow, the presence of a body of magma at a rather shallow depth is inferred, the probability being that a sill-like body of no great thickness was intruded between the horizontal strata beneath the valley, while the load of the mountain blocks on either side prevented the intrusion from extending beneath them. With the escape of a portion of the magma through the fissures a partial subsidence would follow, and the facts observed are consistent with this theory. The marked diminution in temperature and volume of fumarolic vapours between 1919 and 1923 supports the conclusion that the source of the emanations is a comparatively

small body of igneous rock. Mr. Fenner does not believe that the fracturing in the valley was the *cause* of the tectonic earthquakes, as has been thought by some.

AUSTRALASIA AND PACIFIC ISLANDS

The Barrington River, New South Wales.

A portion of the upper reaches of the Barrington River, New South Wales, was explored by Messrs. Cavalier, Neve, and Hewit in December 1923, and again by Messrs. Cavalier, Neve, and two companions a year later. The Barrington pursues a tortuous and violent course down the slopes of the Mount Royal Range to the plains below, ultimately flowing into the Gloucester River. When this area was being surveyed, the Barrington was mapped up to a point where it emerges from a wild gully. The survey of the river was picked up 5 miles farther on, and its intervening course approximately indicated. Mr. Cavalier has called this gully "Sassafras Gully," and has sent to us copies of the *Newcastle Sun* for 2 January 1924 and 6 January 1925, containing accounts of its exploration. It was apparently rumoured that this gully contained some great waterfalls. On his first visit Mr. Cavalier's party descended into the gully and examined a portion of its course. The descent of 1000 feet through thick scrub was difficult, and only carried out with the help of ropes. The river was found to tumble down in a series of small waterfalls 10 to 30 feet every few yards. In the next visit, his party followed the course of the river through the gully. In the middle the walls of the gully were 1500 feet high and nearly perpendicular, so that the going was very difficult in places, and it took twelve hours to do 4 miles. After spending one night in the ravine they emerged the next day, having discovered no striking falls. No attempt seems to have been made to map the course of the river.

Soundings in the Sea round New Zealand.

In a short paper in the *New Zealand Journal of Science and Technology*, a reprint of which has been received from the author, Mr. H. T. Ferrar calls attention to various problems connected with the sub-oceanic relief of the region round New Zealand which cannot yet be solved owing to the paucity of soundings so far made in those seas. He gives a sketch-map showing the distribution of such soundings as are available (together with the depths obtained), and bringing out clearly the fact that while to the north-east, north, and north-west of the North Island they are so numerous that all cannot be inserted, to the east of the same island few have been made far from the coast, while west of the South Island a large area is entirely free from soundings, and throughout the whole area south of 40° they are for the most part widely scattered, and have been made chiefly along one or two lines only. Among the questions awaiting solution are the following: Does the Kermadec Deep extend southwards and cut off the Chatham Islands from New Zealand? What happens to the east-west contours which run north and south of the Chatham Islands and correspond to the dominant strike of the schists of the group? Are the Chatham, Bounty, Antipodes, and Campbell Islands on a ridge or on the edge of a submarine platform? Does deep water separate Ross Dependency from New Zealand, or is there a connecting rise as shown (apparently without sufficient grounds) in bathymetrical maps? It is evident that a research expedition in these seas would find much good work to do even in this department only.

POLAR REGIONS

Theory of Polar Climates.

In the *Quarterly Journal of the Royal Meteorological Society* for April 1925, Mr. C. E. P. Brooks, well known for his numerous researches * in palæoclimatology, develops a remarkable new theory of polar climates, according to which the Arctic Ocean must either be intensely glacial as at present, or else mild and completely ice-free as at epochs in the past, the intermediate periods being unstable. He starts with the proposition that once the freezing of a polar ocean can commence, the ice formed tends to extend and perpetuate itself in accordance with the known principle that surfaces of ice and snow greatly increase the original cold, so that a small circum-polar ice-cap will grow until its confines reach latitudes where a limit to the process is reached. He calculates that, if over an open polar sea the winter temperature falls but a fraction of a degree C. below the freezing-point of water, an ice-cap will develop, extending rapidly to about lat. 78°, and then more slowly to about 65°, except where disturbing factors like warm currents may interfere with growth; the growth being finally arrested when the outer portions of the ice-cap cease, owing to distance from the central parts, to exert their full cooling effect per unit area of the cap. The ultimate lowering of the winter temperature brought about by the initial fall of a fraction of a degree below freezing will amount to about 25° C. A certain critical point on which turns the issue whether there will be a glacial or warm polar ocean represents a delicate balance of effects. Below the critical point all the cooled water remains on the surface as ice, spreading cold all around it and in various ways maintaining and intensifying the frost; above it, on the other hand, the water in cooling becomes denser and sinks to the bottom, where it drains away as a ground current, to be replaced by warm water from lower latitudes.

Brooks adopts the conception, due originally to F. Kerner-Marilaun, of "akryogenous" temperature, calculating hypothetical distributions of temperature on the assumption that sea-water, with all its other properties unchanged, should reach its freezing-point and maximum density at a much lower temperature than the actual, since in the investigation it is necessary to calculate from continentality relationship the distribution of temperature as it would be if uncomplicated by the effects of floating ice. Applying these considerations to the present geographical configuration of the Arctic, and the inferred configuration in past geological ages, Brooks, in the light of palæontological evidence, reaches the conclusion that the case for an ice-free Arctic Ocean in the past is well established. There is, further, a good deal of evidence that even since the Quaternary Glaciation in North-Western Europe the temperature of the Arctic Ocean has risen above the critical point for ice-formation. The failure of the Norsemen in their voyages from Greenland to Wineland to mention ice is attributed by Otto Pettersson to the non-dispersal of the Polar ice so far south, but according to Brooks the omission signifies the absence of any ice in the Arctic Ocean to come south at all. In the discussion which followed the paper the question was put to Mr. Brooks whether there is any indication that during the supposed non-glacial period in the Arctic occurrences of frost and snow in England were markedly less frequent than at present, since this must inevitably follow especially in spring, a season which at the present time under the influence

* For the author's previous papers on climatic continentality, see reference in *Geo. Journ.*, vol. 64, p. 51.

of polar winds tends, somewhat disproportionately to the depth of winter, to be so bleak and snowy. Mr. Brooks replied that the evidence was unreliable, but that what there was pointed to rather milder winters in the epoch immediately preceding the Norman Conquest. This new theory of Brooks', which appears to be sound, emphasizes the far-reaching importance of ice and snow as climatic factors, and it is a striking exemplification of the author's more general theory that geographical changes are in themselves ample to explain geological vicissitudes of climate without invoking external non-terrestrial causes. Polar latitudes, though they must necessarily be cooler than equatorial, so long as the sun is the sole source of warmth to the Earth's surface, need not necessarily be glaciated. Whether they are or not depends upon the configuration of land and sea and all that this implies in the way of altitude, currents, etc. If the Arctic Ocean in its present continental setting and light snowfall were replaced by land at sea-level there might be no summer glaciation, as, indeed, is maintained by Stefansson.

GENERAL

Gilchrist Studentship: 1926-27.

The Gilchrist Trustees again offer a Geography Studentship of £80, with a view to the improvement of the teaching of geography in schools. The Studentship is tenable at any recognized School of Geography. Applicants, who should be teachers with at least two years' experience, should send their names to Professor L. W. Lyde, University College, Gower Street, W.C.1, before 1 February 1926. They must give references and a full account of their previous work, with three recent testimonials. Further particulars may be obtained from Prof. Lyde.

OBITUARY

The Right Hon. Sir George Taubman Goldie, K.C.M.G., F.R.S., D.C.L., LL.D.

THOUGH his name is not enshrined in that of the great possession which he made for the British Empire—for Sir George Goldie discouraged the arts of publicity—he must eventually take his place in our Empire's history as the greatest and most accomplished of its builders. In the short interval between 1877, when he first visited the Niger, and 1884, when the Berlin Conference was held, he had by boldness and strategy consolidated into one strong company the many small independent British enterprises which he found on his arrival, and had succeeded in acquiring the competing French interests on the river; he had completed over four hundred political treaties with the chiefs of the Lower Niger and the Hausa territories; and he was able in the nick of time to declare that only the British flag flew on the lower river. In the years following the Berlin Conference the Niger Company had to face the resolute antagonism of Prince Bismarck as well as the expansive ambitions of French neighbours; but the position was consolidated by the long-delayed grant of a charter in 1886, and by the signature of a convention with France in 1898, in which negotiation Sir George is said to have played a resolute part. The Royal Niger Company had one and only one serious internal trouble, when in 1897 the Emirs of Nupe and Ilorin provoked short-lived hostilities. For

the rest, the base principle of their administration was a scrupulous respect for native rights, and protection against the worse evils of alcohol.

On 1 January 1900 that Company, having fulfilled its constructive mission, surrendered its charter, and the administration of its great territories, to the Imperial Government, when Sir George Goldie resigned his position as Governor of the Company and took no further active part in its affairs. After a long holiday and journey round the world he turned to other public interests, sitting on Royal Commissions, and as an Alderman of the London County Council.

Sir George had joined the Society in the same year that he paid his first visit to the Niger, and had served for many years on its Council. When the time came to find a President to succeed Sir Clements Markham, who had ruled the Society for the unprecedented term of twelve years, the Council naturally turned to the man whose geographical and administrative talents fitted him especially for a position of some delicacy. During his three years of office, from 1905 to 1908, he brought all his experience to bear upon the welfare of our Society: and one of his reforms has proved its salvation. In 1908 he persuaded a General Meeting to raise the subscription for newly elected Fellows from two pounds to three pounds per year. Since 1908, therefore, the income of the Society has grown steadily by the gradual substitution of subscribers at a higher rate, apart from the increase in the total Fellowship. Thanks to this, in the hard times which followed the War it was just possible to carry on without any further increase in the subscription, which might have proved disastrous. We owe much, therefore, to the prudent resolution of our President of 1908.

In another matter he was less successful, and failed to carry his point. For many years the Society had outgrown the accommodation of No. 1, Savile Row, and the Council were looking for a new house. The President's eye fell on the large block of houses standing on an island site in the Cromwell Road opposite the Victoria and Albert Museum. They had been empty for long, and had even acquired the reputation of being haunted. Sir George was anxious to buy the site, demolish the houses, and build a joint home for this and one or two other Societies. But the scheme met with unexpected opposition, partly because the position was said to be too far west, and to his permanent disappointment he had to withdraw it, little thinking that a few years later the Society would be splendidly housed in a much finer position, but on the same meridian.

A signal event of his Presidency was the great meeting in the Albert Hall, when on a Saturday in January 1907 King Edward the Seventh as Patron of the Society, with His present Majesty, then Prince of Wales, heard H.R.H. the Duke of the Abruzzi lecture on "The Snows of the Nile," and afterwards proposed the vote of thanks. This was the only occasion in our history when the Sovereign Patron has been present at a meeting.

Sir George Goldie earnestly maintained the efforts of the Society to raise the standard of geographical education throughout the country, and in particular to establish it as an honours subject in the Universities. He succeeded in securing its restoration to a proper place in the examinations for the Civil Service. He had a high conception of the field and functions of geography, which he expressed in his three Presidential addresses to our Society, in his address to Section E of the British Association at York in 1906 (*Geogr. Journ.*, **28**, 377), and especially in a striking speech on "Geographical Ideals" to the Royal Scottish Geographical Society in November 1906 when he received the Livingstone Gold Medal (*Geogr. Journ.*, **29**, 1).

During the last years of his life Sir George was compelled to winter abroad, and was rarely able to attend the Council. He therefore in 1921 resigned the position of Foreign Secretary, which he had held for ten years. His portrait by Herkomer, painted as a present from the Niger Company, hangs on loan over the fireplace in the Map Room, recalling to the memory of all who knew him the slight, fair, undaunted figure that played so large a part in the history of his time.

J. Y. Buchanan, F.R.S.

MR. JOHN YOUNG BUCHANAN, who died in London on 16 October 1925, was born in Glasgow in 1844, studied at the University of Glasgow, and specialized in chemistry under several of the famous chemists of the Continent. He was appointed chemist and physicist to the oceanographical expedition on H.M.S. *Challenger* in 1872, and made continuous observations of salinity, analyses of oceanic deposits and minerals, and researches on pressure, temperature, and movements in the deep sea supplementary to those of the naval officers. He kept abreast of the work of all his colleagues, and although starting as a chemist he widened his purview to embrace all the phenomena of physical geography. Very soon after the return of the expedition he offered a paper to the Royal Geographical Society on the Distribution of Salinity in the Great Oceans (*Proceedings* R.G.S. for 1877) which included the first map of salinity ever produced and enabled the author to establish the close accord of the isohalines of the sea with the isobars of the air. Nearly ten years later he gave a very important lecture to the Society on the Homologies of the Great Oceans (*Proceedings* R.G.S. for 1886), and in 1895 he contributed a valuable historical retrospect of Oceanography to the Sixth International Geographical Congress in London. He continued his oceanographical researches in his own yacht, in the cable-laying ships of the Silvertown Company, and in the splendidly equipped yacht and laboratories of the Prince of Monaco, with whom he was on terms of close comradeship. Later, when he had retired from the active labours of research, he collected many of his papers in three volumes, published by the Cambridge University Press; but a large part of his work remained in the form of carefully-kept notes which he had never prepared for publication.

In 1889 Mr. Buchanan was appointed Lecturer on Geography in the University of Cambridge, and he occupied this position for four years. His love of travel, which his ample means allowed him to gratify to the full, familiarized him with all the routes and nearly all the countries of the world, and he kept very full diaries which have never been utilized except for providing first-hand observations in illustration of his own lectures. Although Mr. Buchanan's main claim to remembrance is the large share which he took in the foundation of modern oceanography, he was also keenly interested in glaciers and in desert conditions, which he investigated in many parts of the world. He was the author of more than a hundred scientific papers, which however did not nearly exhaust the immense amount of original material which he collected.

Mr. Buchanan was of a reserved and retiring disposition, but his friendship was greatly esteemed by the few congenial souls whom he admitted to his confidence. H. R. M.

CORRESPONDENCE

Ancient Mines in Egypt

My attention has been drawn to a note in the *Geographical Journal* for November (p. 473) headed "Ancient Mines in Egypt," in which it is stated that my paper entitled "The Emerald Mines of Northern Etbai" (*G.J.*, Nov. 1900) makes it appear that I am "the practical re-discoverer of the Mines." I should be sorry if such a construction could be put upon my paper, for I have never thought of making such a claim.

I did not mention Captain Seton-Karr, but neither did I mention Caillaud, "who had worked the mines a century or so previously." In fact, there was no need to do so for the scope of my paper was deliberately restricted to an account of the part I played in the expedition which I accompanied as geologist.

In the note I am charged with using Captain Seton-Karr's map to illustrate my paper. The map and sketches which I used for that purpose were entirely my own original work and based on data derived from personal observations. It can be seen that my map bears little resemblance to Floyer's map which is embodied in Captain Seton-Karr's monograph.

Donald A. MacAlister.

8 November 1925.

Note by the Editor G.J.

The final phrase of our note in the November *Journal*, which had been much condensed, was an unfortunate confusion of the compiler, which we much regret. The "matter of fact" was, not that Mr. MacAlister had used Captain Seton-Karr's map but that Captain Seton-Karr had used the map of Mr. Floyer (*G.J.*, May 1893). The detailed sketch-maps published by Mr. MacAlister in 1900 owe nothing to Captain Seton-Karr.

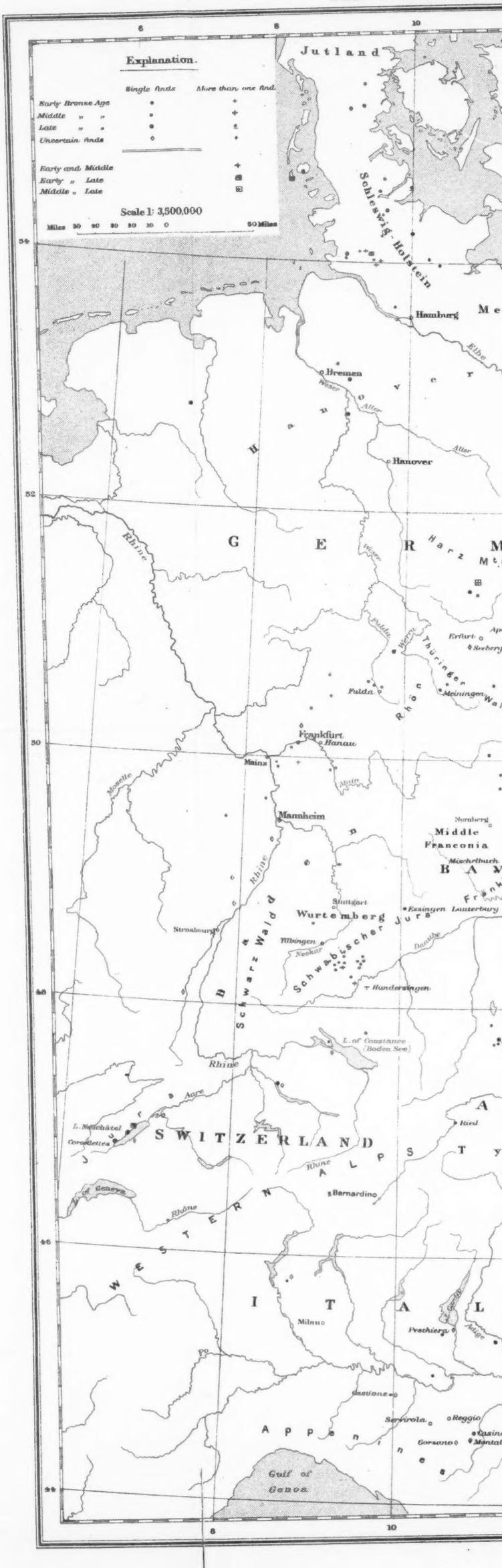
MEETINGS, R.G.S.: SESSION 1925–1926

First Evening Meeting, 9 November 1925.—The President in the Chair.

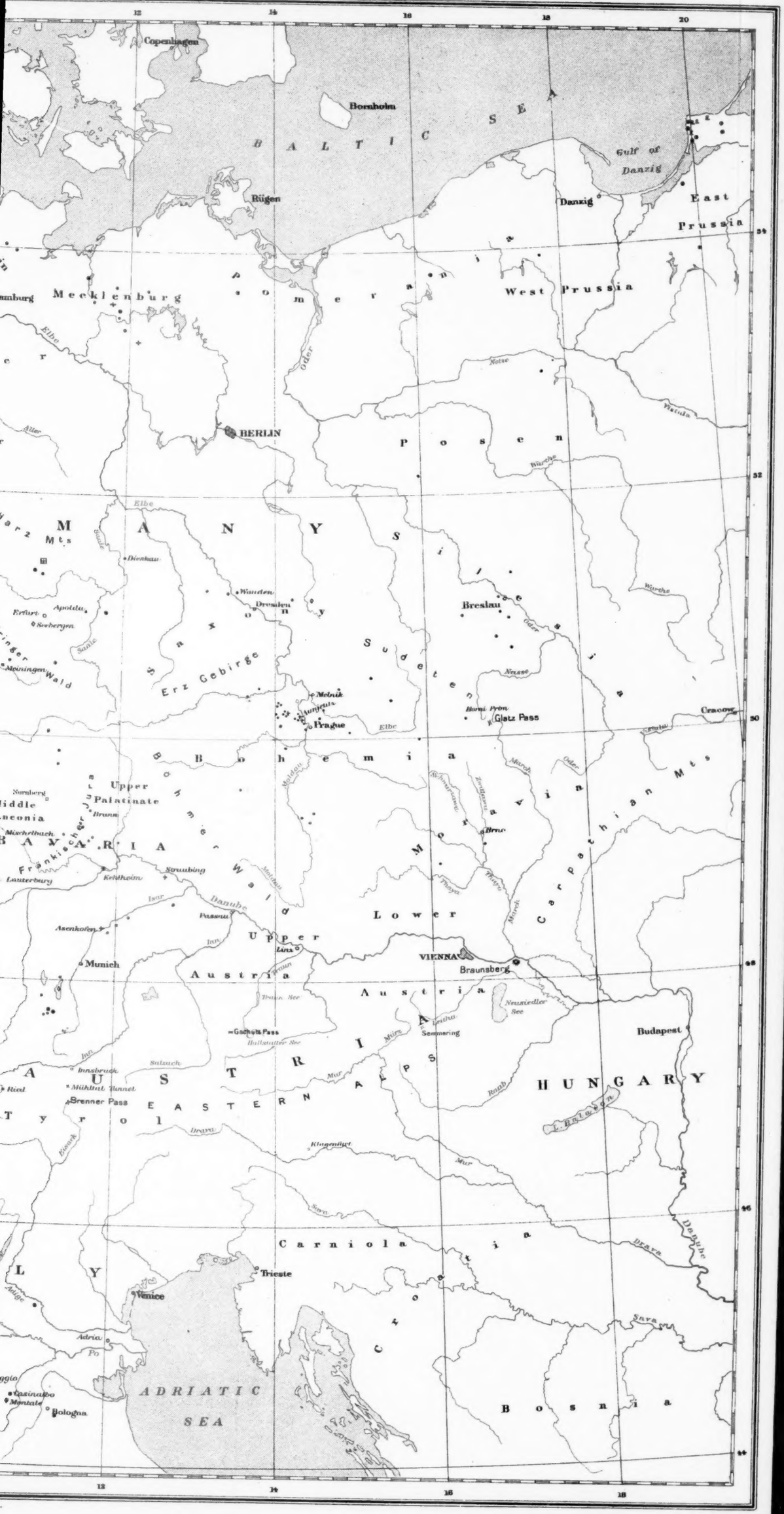
Elections.—Mrs. Blanche Marie Ames; Alexander Pursey Bacon, B.Sc.; Miss Winefride Fitzherbert Brockholes; Cedric Clifton Brown, B.A.; Stanley John Bruford; Frank Burnett; Rev. Benjamin Thomas Butcher; G. R. Carline; Rev. Thomas Lionel Carpenter, M.A.; William Taylor Cathcart, C.I.E.; Rev. Frederick Cawley, B.A., B.D.; John Samuel Chater, M.D.; Amos Chippindale; Cecil Maurice Cotton; James Henry Coyne, M.A., LL.D.; Oscar Sydney Edward Curtis; Bernard Arthur Davis; Rev. Thomas Hawddgar Evans; Paul Fairweather; Gilbert Evelyn Falkner, M.C.; Paul Garnett, B.A.; Lieut. Geoffrey Clarence Grand; William Thomas Gregor, B.A.; William Henry Hammond, M.A., J.P.; Henry F. P. Herdman, M.Sc.; Capt. Eric Anthony Hare-Hobson; W. G. Johnson; William Alfred Jones; S. M. Kazarine, F.S.S.; Robert Archibald Logan; Major Harry Chickall Lott, M.C., A.C.G.I., A.M.Inst.C.E.; Arthur James McMaster; James Edwin Magee; Henry Morgan Monk; Miss Rhona Lloyd Mostyn; Frederick Graham Page; Lieut.-Col. Henry Evelyn Pennethorne; Tudor Henry Phillips; Loring Pickering; Charles Edmonds Powell; C. V. Reade; Prof. Arthur Lindsay Sadler, M.A.; Clifford Reynolds Sadler; Rev. William Dunstan Sargent; William Eric Halstead Scupham, M.C.; Eric Shaw-Baker; Joseph Granville Squiers; Lieut. Richard Harold Redvers Taylor; Sydney Herbert Vizard; Frederick William Whitehouse, M.I.M.M.; Oliver Augustus Leslie Whitelaw; Ian Froome Wilson; R. A. Wilson, I.C.S.; Miss Jessie Euphenia Wishart.

Paper: The Fifth Thule Expedition: From Greenland to the Pacific. Dr. Knud Rasmussen.

MAP I BRONZE A



RONZE AGE AMBER FINDS IN CENTRAL EUROPE



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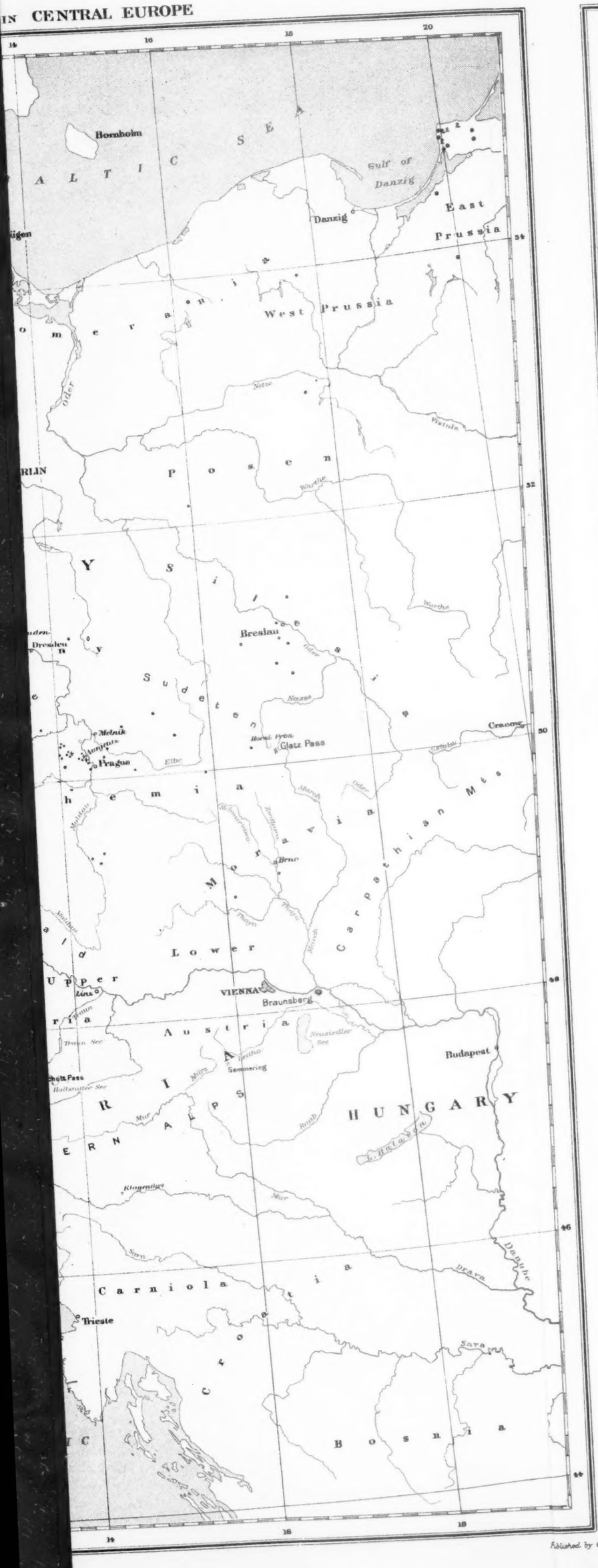

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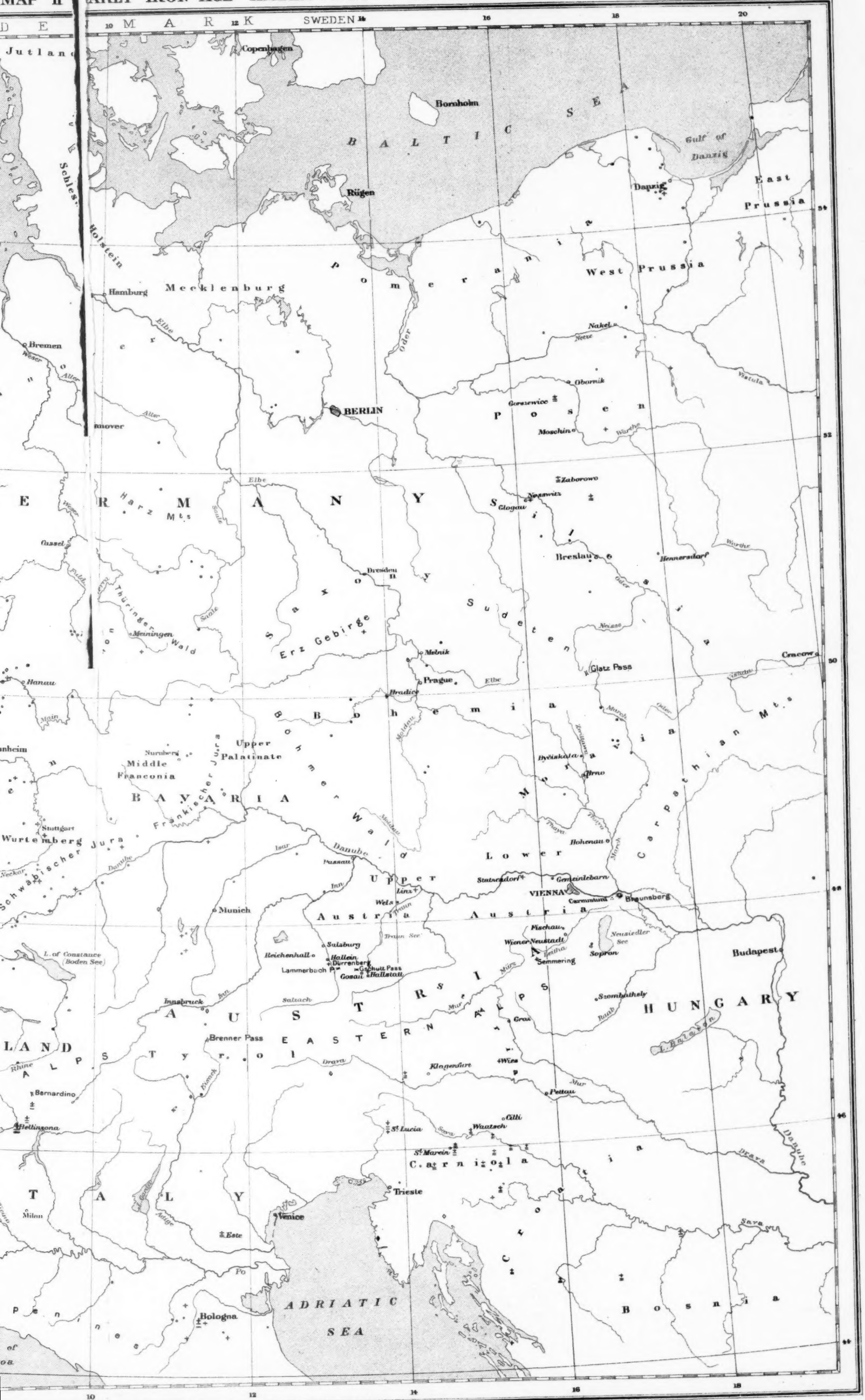

AMBER FINDS IN CENTRAL EUROPE

De Navarro

INDEX

* Denotes Articles and Papers. § Reviews and Notices.

A.

ABDULLAH, Amir of Transjordan, 134 *et seq.*
Abu Dhabi, Trucial coast, Oman, 200
Abyssinia— Lalibala: R. McGrath, 507*
Aconcagua, Mt., Ascent, 44*
Adventures of Exploration: Sir J. S. Keltie and S. C. Gilmour, 373§
Ægean Ids., West Indian and: Sir A. E. Shipley, 275§
Aerial Navigation and Survey in Arctic: Capt. F. Tymms, 126,* 130*; A— Surveying by Rapid Methods: B. M. Jones and Maj. J. C. Griffiths, 463§
Aerophoto Survey . . . of Irrawady Delta: R. C. Kemp and others, 455§
Afghanistan, E. Trinkler's Journey, 175§
Africa. Capt. Delingette's Motor Journey, Algiers to Cape Town, 378; Découverte de l'A— au Moyen Âge: C. de la Roncière, 266§; French Soldier Explorer in A—: R. Rodd, 344*; Vegetation and Soils of: H. L. Shantz and E. F. Marbut, 552§; Wonderful A—: F. A. Donnithorne, 268§
———, East, at Wembley, 176
———, South, Plant Forms and their Evoln. in: J. W. Bews, 265§: South A—n Drought, J. O. Schonken on, 567§
African Reminiscences, My: Ven. W. P. Johnson, 66§
Afrique Equat. Française, Mission de Délimitation, etc.: Lt.-Col. Grossard, 349*
Aga, C. Africa, position, 352
Aghilistan pass, Kashgar Range, 399
Ahkdhar, Jabal, Oman, 213
Ailianos, M., quoted on racial movements in Balkans, 318, 319
Ain, Oman, 208
'Ain Jiddi (Engeddi), Dead Sea, 140
—— Malih, spring, Allenby Bridge, Jordan, 530, 533
—— Sultan or Elisha's Fountain, Jericho, 531
Ainsworth-Davis, J. R.: Resources of Empire: Food Supplies, 258§
Aircraft in Arctic, 13
Air Ministry and Oxford Univ. Arctic Expdn., 11
Alaska: Empire in Making; J. J. Underwood, 555§; Handbook of A—, etc.: Maj.-Gen. A. W. Greely, 555§; North-Western A—, P. S. Smith on, 282§
Aldous, Lt. J. R. T., surveyor, Oxford University Arctic Expedition, 11, 37
Alert, H.M.S., at Pim Id., Smith Sound, 540
Alexander, J. B., on route of Lord Southesk in W. Canada, 253
Alfinger, explorn. in Colombia, 98
Al Ghar, Wadi, Dead Sea basin, 140
Almacenes, Mt., Andes, 45
Almagià, R., on Seventeenth-century Maps of Italy, 172§
Alphonso XIII. of Spain, Hon. Member of R.G.S., 75
Alps of Qungur: C. P. Skrine, 385*
——, Italian, Under: E. L. Broadbent, 449§
Altunluk, Kashgaria, 389 396, 408
Alukthang glacier, Sikkim, 334
Alvarez, Father, visit to Lalibala, 507
'Alya, Wadi, Dead Sea basin, 139
Amazon Basin, Population, W. L. Schurz on, 379§
Amber Trade, Prehistoric Routes . . . defined by: J. M. de Navarro, 481*
America: True History of Discovery: W. G. Nash, 269; Atlantis in A—: L. Spence, 466§
———, North: Historical, Economic and Regional: L. R. Jones and P. W. Bryan, 164§; Discovery, Twenty Years before Columbus: S. Larsen, 68§; N— A—n Game Fields, With Shot-gun and Rifle in, Capt. B. W. Robinson, 457§; St. Lawrence–Great Lakes Deep Waterway, R. E. Freeman on, 380§
Americana, Early, 569
Amundsen's Polar Flight, 48*
Ancha, Rio, Colombia, 102
Andes uplift, 97
Andrew, G. W., Edr.: Resources of Empire: Fuel, 258§
Andrews, M. C., on Portolan Charts of N. Ireland, 478§
Anglo-Egyptian Sudan, Mission de Délimitation, etc.: Lt.-Col. Grossard, 349*
Antarctic Expln., Motor Tractors for, 442*
Antoniades, A., quoted on population in Thrace, 326 *et seq.*
Apparent Magnitude in Natural Scenery: V. Cornish, 427*
'Aqaba, Arabia, 153–154; prison at, 151
———, Gulf of, 153–154; and Dead Sea hydrology, 145
Aqsi Davan, pass, Kashgar Range, 398
Arab as a soldier, 146
—— chronicle on Moslems at Lalibala, 508

'Araba, Wadi, Dead Sea basin, 142, 148
Arabia, unexplored, 4; Through Inner Deserts to Medina: Countess Malmignati, 452§; Vanished Cities of A—: Mrs. S. Erskine, 61§; With Lawrence in A—: L. Thomas, 359§
Arctic— Flying in, 48 *et seq.*; Hunting and Adventure in: F. Nansen, 462§; Little Problem of, 539*
—— Expedn., Macmillan, 382; Oxford University: F. G. Binney, 9*, 111*
Arctic, ship, discovery by, at Pim Id., Smith Sound, 540
Arctowski, H., Geothermic Researches made at Borysław, 422*
Argentina, Work and Play in: Capt. J. Macnie, 365§
Arhuaco Indians, Colombia, 102–103
Armenians in Thrace, 328, 329
Arnold, W., on survey work of Rice's expedn. to Rio Branco, 46
Arpa Bel, pass, Kashgar Range, 406
Art Treasures in Soviet Russia: Sir M. Conway, 263§
Arun river, Himalaya, hydrology, 300, 313
'Arus, 'Ain, Dead Sea basin, 142
Âryâvarta, Heart of: A Study of . . . Indian Unrest: Earl of Ronaldshay, 162§
Ashe, A. W., and H. G. T. Boorman, Resources of Empire: Chemicals, 259§
Asia: J. Thomas, 373§
——, North-East, and Internat. Map, 446
——, Western, Travels of Benjamin of Tudela, P. Borchardt, 78§
Astrolabe Mts., Papua, 523, 525
Astrolabes at Oxford, 43
Astronomy, Military Uses: F. C. Molesworth, 169§; Practical, etc.: G. L. Hosmer, 465§
Atacama, Laguna Colorada in, 475§
Atlantic, Deep-sea Deposits, Sir J. Murray and J. Chumley on, 283§
Atlantis in America: L. Spence, 466§
Atmospheric effects in scenery, 427 *et seq.*
Aunjetitz civilization in Bohemia, 485–486
Australia, Adventures of A. B. Peirce in: *Ed.* Mrs. A. T. Leatherbee, 367§; Early Explorers in: I. Lee (Mrs. C. B. Marriott), 69§; History of A—n Land Settlement, 1788–1920; S. H. Roberts, 367§; Kangaroo keeps on Talking: L. St. Clare Grondona, 271§; Walk round A—, A. de Brune on, 382
———, South, Foundation and Settlement: A. G. Price, 460§
———, Western, etc.: J. S. Battye, 367§
——— and Internat. Map, 446–447
Australien u. Newseeland geogr. u. uirtschaftlich: K. Hassert, 401§
Avroman Mts., Iraq–Kurdistan, 234
Azimuth-problem of Wineland, 53 *et seq.*

B.

Back Grant to Capt. Bernier, 94
Bacon, Lt.-Col. C. R. K., on Depth of Nile Mud in Sudan, 479
Badawi raids in Palestine, 142
Baghagh, Wadi, Dead Sea basin, 141
Bahai, C. Africa, position, 351
Bahr-el-Ghazal and Anglo-French relations, 346
Bailey, Maj. F. M., Note on portion of Tsangpo, 519*
Bait Tamir, near Jerusalem, 139
Baker, Lieut. H., of Spitsbergen Expedn., 1924..37
Balearic Isles, Travel in Italy and: D. Goldring, 357§
Balkans— My Wanderings in: D. Heathcote, 451§; Racial Migrations in, during 1912–1924: A. A. Pallis, 315*; Two Vagabonds in: J. and C. Gordon, 59§
Baltic amber trade, 497, 500
—— Region, M. Haltenberger on, 173§
—— States, New: O. Rutter, 449§
Bani 'Atiya tribe, Dead Sea basin, 147
Baptist Mission in Shantung, etc., Story of: E. W. Burt, 549§
Baraimi oasis, Oman, 203–204, 207, 226–227
Bara Shigri, glacier, Lahaul, 333
Barche glacier, Kashmir, 333
Barrington River, New South Wales, Expln. by Messrs. Cavalier, Neve, and Hewitt, 571
Bartholomew, J., Maps by, in World Missionary Atlas, 371§
Bartolozzi, Vespucci letter printed by, 349 *et seq.*
Basques and their Country: P. S. Ormond, 548§
Battye, J. S., Western Australia, etc., 367§
Baumann's visit to Uha, Tanganyika Terr., 415
Beach, H. P., and C. H. Fahs, World Missionary Atlas, 371§
Bear Id. and Spitsbergen, Norwegian Research in, by Hoel, etc., 476§
Béhagle, F. de, memorial Tablet, etc., in Bornu, 281
Behrend, F., on C. African Geology, 414
Behrens, quoted on Bronze Age in Germany, 487
Beke, C., on Wali Muhammad Baqir, Hejaz, 153
Belgian Congo, new map, 378§
Bell, Sir C., Tibet Past and Present, 59§
Bella, P. de, on Emigration from S. Italy, 470§
Bernacchi, Lt. Comm., experiments on motor tractors for Antarctic, 442
Bernier, Capt., Back Grant to, 94
Bertarelli, L. V., Northern Italy, etc. (Blue Guides), 358§
Best, E., The Maori, 270§

Bews, J. W., Plant Forms and their Evoln. in South Africa, 265 §
"Bilu" and Sultan funerals, Uha, Tanganyika Terr., 419
Binkley, R. C.: *see* Graham, M. W.
Binney, F. G., leader of Spitsbergen Expedn., 1924..37; on Amundsen's polar flight, 51; Oxford University Arctic Expedition, 9*; remarks on "Rocks and Glaciers of Mt. Everest," 314
Birket, M. S., Resources of Empire: Ferrous Metals, 259 §
Blanford, Dr., on Tibetan ice-sheet, 313
Blizzard Plateau, North-East Land, 22
Blue Guides: *Ed.* F. Muirhead, 358 §
Bohemia, early history, 491; antiquities, 485-486
Bolton, E. R., and R. G. Pelly, Resources of Empire: Fats, Waxes, and Resins, 259 §
Boorman, H. G. T.: *see* Ashe, A. W., 259 §
Borchardt, P., on Benjamin of Tudela in W. Asia, 78 §
Bordeaux time signals, 245
Borneo, Centr., Dutch Explorn. in, 567 §
Borysław, Geothermic Researches at: H. Arctowski, 422*
Boulnois, Capt. P. K., on Sudan boundary, 349, 352
Boulter, B. C., Illusts. to Ellaby's Rome, 358 §
Bowcock, E. W., Shropshire Place-names, 545 §
Bowen, F. C., The Sea: its History and Romance, 276 §
Boyce, A. A. R., Sudan Survey Report, 1924..160 §
Branco, Rio, Dr. Rice's expedn., 5, 46*
Brazil after Century of Independence: H. G. James, 555 §
—— and Internat. Map, 447
Breckland, Studies of Vegetation: E. P. Farrow, 544 §
Bristol: A. L. Salmon, 162 §
Britain, Greater, Growth of: J. Fairgrieve and E. Young, 278 §
——, Roman, Last Age of: E. Foord, 548 §
British Commonwealth, Military Geography of: Maj. A. E. W. Salt, 468 §
—— Empire, etc.: A. Demangeon, 372 §; Empire at War: Sir C. Lucas, 559 §; Resources of E—, 257 §; Survey in Twelve Vols.: *Gen. Ed.* H. Gunn, 257 §; Wall Map, 478 §
—— Government in India: Marquis Curzon, 335 §
—— Imperial Wireless Service, 246
—— Isles: R. E. Parry, 373 §; *see also* Great Britain
Brittany: F. Muirhead and M. Monmarché (Blue Guides), 358 §
Broadbent, E. L., Under Italian Alps, 449 §
Broadcast, British, heard in Spitsbergen, 26
Bronze Age, chronology, 503
Brooke, Capt., of Turco-Persian Boundary Commission, 234
Brooks, C. E. P., on Theory of Polar Climates, 572 §
Brouwer, H. A., *Ed.* Practical Hints to Scientific Travellers, 468 §
Brown, R. N. R., new member of Council, 9
Browne, G. St. J. O., Vanishing Tribes of Kenya, 65 §
Bruce, Gen. Hon. C. G., Founder's Medal to, 92; responds to toast of Gold Medallists, 187: work in Himalayas, 4
Brune, A. de, Walk round Australia, 382
Brunn, Palatinate, antiquities, 488
Bryan, P. W.: *see* Jones, L. R.
Buchanan, J. Y., obituary, by H. R. M., 575
Buckinghamshire Place-names: A Mawer and F. F. M. Stenton, 547 §
Büdel, Dr., on changes at Mouth of Kur (Caspian), 566 §
Bulgarian migrations, 315 *et seq.*
Bunsen, Rt. Hon. Sir M. E. de, seconds vote of thanks to President and Council, 95
Bunting, W. L., Where Geography and History meet, 373 §
Bureau International de l'Heure, 242 *et seq.*
Burma, Water Transport of Timber in, Maj. R. S. Wickham on, 472 §
Burrard, S. G., obituary of Prof. J. F. Hayford, 82
Burt, E. W., Fifty Years in China, 549 §
Burton, Sir R., on ancient Midian gold, 153
Bushongo, On Trail of: E. Torday, 64 §
Butterworth, C. M.: *see* Lyde, L. W.

C.

CALCIATI's work on Himalayan glaciers, 333
Calcutta, Government House, 335–336
Calgary Historical Society, 246–247
Californian Continental Shelf, A. C. Lawson on, 568 §
Cambodge et Cambodgiens: H. P. Collard, 550 §
Canada, Topographical Mapping, 281; Sixth Census, 458 §
——, West, Southesk's Journey through, 246
Canadian Rockies, Trail life in: B. W. Mitchell, 457 §
Canerio map and Vespucci, 342
Caraci, G., on Early English Charts at Florence, 383 §
Caribbean Sea and Sargasso weed, 437
Carnegie, Hon. D., Memorial, 77
Carniola amber antiquities, 499
Carslake, W. B., of Spitsbergen Expedn., 1924..37

"Carte Identique," Turco-Persian Boundary, 228, 237
Cartography. Kartenwissenschaft: M. Eckert, 557 §
Cary, John, Engraver, etc.: Sir H. G. Fordham, 560 §
Castanhoso, visit to Lalibala, 507–508
Cattaui Bay, A., obituary, by W. F. H., 179
Caucasus. In Land of Golden Fleece: O. Keun, 63 §
Caavlier, Neve and Hewitt, expln. of Barrington River, N.S. Wales, 571
Cawdor, Lord, explorations in S.E. Asia, 5
Červinka, —, on amber finds in Czecho-Slovakia, 489
Central Bureau for Internat. Map, 448
Ceylon Government Railway: G. S. S. Gordon on, 471; Wild C—: R. L. Spittel, 455 §
Chambers of Commerce Atlas: *Ed.* G. Philip and T. S. Sheldrake, 563 §
Chaplin, Lt.-Comm. J. M., of *Discovery* research expedn., 42
Charts, Early English, at Florence, G. Caraci on, 383 §
Cheesman, Major, Cuthbert Peek Grant to, 5, 94
Chester, Bishop of, Tribute to Mallory and Irvine, 4
Childe, G., remarks on "Prehistoric Routes," etc., 505
Chimghan Jilgha, Kashgaria, 397
China, American Barbarian in: U. Close, 360 §; Fifty Years in, E. W. Burt, 549 §: Guide to, 361 §; works on C— in new Tokyo Library, 543, 544
Chinese Customs Service: P. King, 63 §
Chomolhari Mt., Himalaya, 298
Chomoyumo, Mt., Himalaya, 298
Chumley, J.: *see* Murray, Sir J.
Clarke, Col. A. R., Memorial to, 478
Clayton, Sir G., remarks on "Dead Sea to 'Aqaba," 155
Clements, J. B., on Vegetation, Climate, and Agriculture in Nyasaland, 78 §
Climates, Polar, Theory of, C. E. P. Brooks on, 572 §; C. H. Pollog on, 282 §
Close, Col. C. F., Western Frontier of Sudan, 349 *
——, U., In Land of Laughing Buddha, 360 §
Clowes, A. J., of *Discovery* research expedn., 42
Clutterbuck, H. M., of Spitsbergen Expedn., 1924..37
Cochrane, J., on geology of Aconcagua, 45
Cockayne, L., Vegetation of New Zealand, 166 §
Coke, R., Heart of Middle East, 454 §
Coleman, Sergt. A., survey of Kolahoi glacier, Kashmir, 331
Coles, K. A., In Broken Water, etc., 357 §
Collard, P., Cambodge et Cambodgiens, etc., 550 §
Colombia, Land of Miracles: B. Niles, 555 §
Colonial Geography, Study in, A. Demangeon, 372 §
Colorado, River. Down Grand Canyon: L. R. Freeman, 269 §
Colour, Menace of: J. W. Gregory, 273 §
Colours in landscape, 428
Colquhoun, Lt.-Col. Sir I., of Spitsbergen Expedn., 1924..37
"Columbian" World Map, De La Roncière on, 284
Columbus, Geographical Conceptions of: G. E. Nunn, 465 §; Discovery of N. America Twenty Years before: S. Larsen, 68 §; Vespucci and, 339 *et seq.*
Commerce, Chambers of, Atlas: *Ed.* G. Philip and T. S. Sheldrake, 563 §; C—, Liberty, Religion, 1683–1793: J. W. Jeudwine, 562 §
Commercial Geography. Fondamenti di G— C—: L. de Marchi, 73 §
Compass in Arctic, 128
Congo Free State and Anglo-French relations, 346
Conway, Sir M., Art Treasures in Soviet Russia, 263 §; remarks on "Prehistoric Routes . . . defined by Amber Trade," 504
Copper-plate printing, 534
Coppet, — de, visit to Lalibala, 509, 512, 514
Coral Creek, W. Canada, 252
Corcellette lake-dwelling, antiquities, 495 §
Cordier, H., death of, 3; obituary, 179
Corney, B. G., bequest to R.G.S., 7
Cornish, V., Apparent Magnitude in Natural Scenery and its determining Causes, 427 *
Cotswolds, Long Barrows of: O. G. S. Crawford, 546 §
Cowie, Major, work on Turco-Persian Boundary, 232, 236
Cox, Maj.-Gen. Sir P., new Member of Council, 9; Some Excursions in Oman, 193 *
Crawford, Earl, on science at Oxford, 44
———, O. G. S., Long Barrows of Cotswolds, 546 §
Crete, Changes in, Capt. A. R. P. Shaw on, 278 §
Cubillo, L., Hon. Corresponding Member, 75
Curzon of Kedleston, Marquis: British Government in India, 335 §; death of, 2
Cushing, S. W.: *see* Huntington, E.
Cuthbert Peek Grant to Major Cheesman, 94
Cyclopæan structure in scenery, 433

D.

Dalhousie, Mt., W. Canada, 251
Daly, R. A., on geothermic data, 425
Dark, S., London, 59 §

Darwin on life in Sargasso Sea, 441
Davies, A. M., letter on Isostasy, 90
Dead Sea, salinity, 144–146, 530, 533
Deasy's height of Qungur Mts., 386, 408, 409; surveys in C. Asia, 407–408
De la Roncière, C., Découverte de l'Afrique au Moyen Age. Cartographes et explorateurs, 266 §; on "Columbian" World Map, 284
Delingette, Capt., Motor Journey from Algiers to Cape Town, 378
Demangeon, A., British Empire, etc., 372 §
Demographical Maps, W. E. Whitehouse on, 81 §
Denmark and early amber trade, 484
Dervish attack on Fashoda, 348
Devold, F. and H., Norwegian rescuers of sea-plane crew, Spitsbergen, 18
Dhaid oasis, Oman, 206
Dibulla, Colombia, 101
Digges, L. and T., and first theodolite, 43
Discovery, Research ship, 40 *
Dixey, F., on Shire Valley, Nyasaland, 472 §; on Vegetation, Climate, and Agriculture in Nyasaland, 78 §
Dixon, Capt. C. C., Sargasso Sea, 434 *
Dominican-Jesuit controversy in China, 544
Donnithorne, F. A., Wonderful Africa, 268 §
Doodson, A. T., on Meteorological Perturbations of Sea-level and Tides, 283 §
Dornan, S. S., Pygmies and Bushmen of Kalahari, 364 §
Douglas, Capt. H. P., new member of Council, 9
Downland, scenic effects in, 431
Dowsett, T. J. L., Rouna Falls of Papua, 522 *
Dra La, Himalaya, geology, 300–301
Duhn—, von, on amber in Italy, 483
Duly, S. J., Resources of Empire: Timber and Timber Products, 258 §
Dutch Explorn. in Central Borneo, 567 §
—— knowledge of North-East Land, 10
Duwairij river, Arabistan–Iraq, 203–231
Dyer, Capt., of Turco-Persian Boundary Commission, 234
Dzakar Chu Valley, geology, 290

E.

EARTH, Riddle of: "Appian Way," 370 §
East, Middle, Heart of: R. Coke, 454 §
—— Anglian Heaths, Plant Life of, etc.: E. P. Farrow, 544 §
Echo-sounding methods, 41
Eckert, M., Die Kartenwissenschaft, 557 §
Economic Geography. Allgemeine-Wirtschafts- und Verkehrsgeographie, 469 §; Introdn. to: W. D. Jones and D. S. Whittlesey, 561 §
Edgar, J. H., on the Wi ch'u, 480
Edom mts., 143
Egerton, Admiral Sir E., on relic at Pim Id., Smith Sound, 536 *et seq.*
Egypt, Ancient Mines in, H. W. Seton-Karron, 473; D. A. MacAlister's reply, 576
Egyptian Sudan, history, 346 *et seq.*
Eiffel Tower time signals, 245
Eilertsen, A., of Spitsbergen Expedn., 1924..37
El Fasher and French Boundary Mission, 350
Elisha's Fountain, Jericho, 531
Ellaby, C. W., Rome (The Little Guides), 358 §
Ellis, A. G. B., sea-plane pilot, Oxford University Arctic Expedn., 13, 37
"Elphinstone" inlet, Oman coast, 198
Elton, C. S., of Spitsbergen Expedn., 1924..37; Arctic Expedn., 1924. Appendix I. Biology in relation to Geography, 111 *
Emanuel church, Lalibala, Abyssinia, 515
England. Through Chilterns to Fens: G. Home, 358 §; Travel in, in Seventeenth Century: J. Parkes, 355 §
——— and Wales, Ordnance maps, 534, 535 *et seq.*; River-terraces and Glacial Drifts of Welsh Border, T. L. Pocock on, 565 §; *see also* Great Britain
English and French practice on boundary missions, 349, 351
Environment, Organic Adaptation to: *Ed.* M. R. Thorpe, 74 §
Eric the Red and climate of Wineland, 54
Erikson, L., Flatey Book's account of his voyage, 54
Erskine, Mrs. S., Vanished Cities of Arabia, 61 §
Erzerum, Treaty of, and Turco-Persian Boundary, 228
Eskimo Friends, My, etc.: R. J. Flaherty, 459 §
Estland, Finnland und Lettland, Litauen: M. Friederichsen, 450 §
Eton Glacier, North-East Land, 30, 35, 119
Europe, Economic Geography: D. H. Smith, 373 §; Prehistoric Routes between Northern E— and Italy defined by Amber Trade: J. M. de Navarro, 481 *
———, Central, New Governments: M. W. Graham, 357 §
Evans, J. W., Introdn. to 'Origin of Continents and Oceans': A. Wegener's book, 70 §
Everest, Mt.; Observns. on Rocks and Glaciers of: N. E. Odell, 289 *; plans for renewed attempt on, 4
Exploration, Adventures of: Sir J. S. Keltie and S. C. Gilmour, 373 §
Eyktarstad-problemet og Vinlandreiserne: M. M. Mjelde, 53 §

F.

FAHS, C. H.: *see* Beach, H. P., 371 §
Fairgrieve, J., and Young, E., Growth of Greater Britain, 278 §
Falkland Ids., Whaling Industry, 6, 40
Farrow, E. P., Plant Life on East Anglian Heaths, etc., 544 §
Fashoda and Anglo-French relations, 346 *et seq.*
Fawcett, Col., survey of Heath River, 6
Febvre, L., Geogr. Introdn. to History, 562 §
Fen Country, scenic effects in, 428
Fenner, C. M., on Earth-movements during Katmai Eruptn., 570 §
Ferrar, H. T., on Soundings in Sea round New Zealand, 571 §
Fiji Ids., Journal of Wm. Lockerby, Sandalwood Trader in, *Ed.* im Thurn and L. C. Wharton, 368 §
Filippi, F. de, Results of Expedn. to Himalaya: T. G. L., 254 §
Findlay, Sir J., on portable dials, 43
Finland, R. Numelin on, 280 §
———, Estland and Lett-land, Litauen: M. Friederichsen, 450 §
Fir forests, Kashgaria, 394, 395, 400
Firms, British, and Oxford University Arctic Expedn., 11
Fischer, J., Hon. Corresponding Member, 75
Fitzgerald Expedition to Aconcagua, 44, 45
Flaherty, R. J., My Eskimo Friends, etc., 459 §
Florence, Early English Charts at, G. Caraci on, 383 §
Florey, H. F., of Spitzbergen Expedn., 1924..37
Florida Straits and Sargasso weed, 436–437
Flying in Arctic, 48 *et seq.*
Fonseca, Bishop, on Vespucci's map, 343
Foord, E., Last Age of Roman Britain, 548 §
Forbes, —, on ribbon structure in glaciers, 307
———, A. Litton, obituary, 179
Fordham, Sir H. G., John Cary, Engraver, etc., 560 §
Fossil Man in Spain: H. Obermaier, 355 §
Founder's Medal to Gen. C. G. Bruce, 92
Fox, C. C., on Yö Ri Gorge, Himalaya, 300
—, C. E., Threshold of Pacific, etc., 366 §
—, Maj. W. H., on Galiton Ids., Tunis, 474
Frazer, R. A., of Spitsbergen Expedn., 1924..37; on glaciology of Spitsbergen, 116
Freeman, R. E., on St. Lawrence–Great Lakes Deep Waterway, 380 §
———, L. R., Down Grand Canyon, 269 §
French Soldier Explorer in Africa: R. Rodd, 344 §
French and English practice on boundary missions, 349, 351
Friederichsen, M., Finnland, Estland und Lettland, Litauen, 450 §
Furdais, Jabal, Judæa, 139

G.

GALILEE, springs near Sea of, source of Jordan and Dead Sea salts, 145
Galiton Ids., Tunis, Maj. W. H. Fox on, 474
Galway, Sir H., remarks on "Sierra Nevada of Santa Marta, Colombia," 109
Gamr, Wadi, Palestine, 147
Ganget, T. de, visit to Lalibala, 508
Garda, Lago di: H. L. Waters, 358 §
Garrett, H. B. G., and A. Kerr, Ascents of Highest Mountain in Siam, 565 §
Garwood, E. J., on geology of Kangchenjunga, 294
Gathorne-Hardy, G. M., New Theory on Wineland Voyages, 53 *
Gaudiche, Dr., of French Boundary Mission, C. Africa, death of, 351
Gaurisankar Mt., geology, 294
Gautier, E. F., Le Sahara (Collection Payot), 268 §
Geddes, Sir E., Gen. Introdn. to 'Resources of Empire,' 258 §
Geer, Baron de, maps of North-East Land, 37
Geneva, Lake of, scenic effects on, 433
Geodetic Congress at Madrid, 8
Geographic Introdn. to History: L. Febvre, 562 §
———— Union, Internat., at Cairo, 8
Geographical Conceptions of Columbus, etc.: G. F. Nunn, 465 §
Geographical Journal, Gen. Index, vols. 21–40, 278 §; scope, 7
Geography. Les Sciences G—: C. Vallaux, 73 §
————, Commercial. Fondamenti di G— Comm.: L. de Marchi, 73 §
————, Economic. Allgemeine Wirtschafts- und Verkehrsgeographie: K. Sapper, 469 §; Introdn. to E— G—: W. D. Jones, and D. S. Whittlesey, 561 §
————, Military, of British Commonwealth, 468 §
———— and History, Relations: H. B. George, 373 §: Where G— and H— meet: W. L. Bunting, 373 §
George, H. B., Relations of Geography and History, 373 §
Geothermic Researches at Borysław: H. Arctowski, 422 *
Germain, L., Vie des Animaux à la Surface des Continents, 274 §
Germany, Western, early amber trade through, 496
Gerritsz, H, Beschryvinghe van der Sa-

moyeden Landt en Histoire du Pays nommé Spitzberge, 556 §
Gharandal, Wadi, Hejaz, 148–149
Ghawarina, tribe, Palestine, 142–143
Ghor as Safi, settlement, Dead Sea, 142
Ghorumde glacier valley, Kashgar Range, 400–401
Giantism in Scenery, 433
Giles, or Gilies, islands charted by, near North-East Land, 25
Gilmour, S. C. : *see* Keltie, Sir J. S.
Giraffe, River of the : F. Savile, 364 §
Glaciers, Indian, Movements of, 331 *
———, Rocks and, of Mt. Everest, Observns. on : N. E. Odell, 289 *
Glatz Pass, Sudeten Gebirge, trade route, 498
Gleichen, Maj.-Gen. Lord E., proposes toast of Gold Medallists, 186 ; remarks on "Sierra Nevada of Santa Marta, Colombia," 106, 110
Gneiss, Himalayan, 294, 297
Goajiro Indians, Colombia, 100
Goldie, Sir G. T., obituary, 384, 573
Goldring, D., Gone Abroad, 357 §
Golgotha church, Lalibala, Abyssinia, 514
Gone Abroad : D. Goldring, 357 §
Gordon, G. S. S., on Ceylon Government Railway, 471
———, J. and C., Two Vagabonds in Balkans, 59 §
Graham, M. W., and Binkley, R. C., New Governments of Central Europe, 357 §
———, R. C., remarks on "Sierra Nevada of Santa Marta," 107
Grant, Capt. C. H. B., Uha in Tanganyika Territory, 411 *
Gray, A. H., Sixty Years Ago, etc., 277 §
Great Britain, Ordnance Maps, 538 ; River Gauging, etc. : M. A. Hogan, 369 §
Great Lakes and St. Lawrence, Deep Waterway, R. E. Freeman on, 380 §
Greek city states, 354
—— influence upon Italian amber trade, 502
—— migrations, 315 *et seq.*
Greely, Maj. Gen. A. W., Handbook of Alaska, etc., 555 §
Green Harbour, Spitsbergen, 14
Gregory, J. W., Menace of Colour, 273 §
Griffiths, Maj. J. C. : *see* Jones, B. M.
Grinlinton, Capt., on Kumaon Glaciers, 334
Grondona, L. St. Clare, Kangaroo keeps on Talking, 271 §
Guides, Blue : *Ed.* F. Muirhead, 358 §
Gunn, H., Gen. Ed. 'British Empire,' 257 § ; Makers of Empire, 257 §
Gunther, E. R., of *Discovery* research expedn., 42
———, R. T., and collection of Scientific Instruments at Oxford, 43
Guru Rimpoche legend, Tibet, 521
Guyer, S., My Journey down Tigris, 62 §
Gyankar range, Himalaya, geology, 300

H.

Habib, Wadi, Oman, 217–218
Hacha, Rio, Colombia, 100
Hadda peak, Oman, 213
Hafit, Jabal, Oman, 206, 208–209, 226–227
Haidas, their Laws, etc. : C. Harrison, 554 §
Haimar, Wadi, Dead Sea basin, 141
Haji Tahir, alleged age, 136
Halfain, Wadi, Oman, 220
Hallstatt, Austria, amber finds, 492
——— Period, chronology, 503
Haltenberger, M., on Baltic Region, 173 §
Hamid Gul, work on Turco-Persian Boundary, 232
Hamilton, J. E., of *Discovery* research expedn., 37
Hamra, Jabal, Oman, 213, 214
Hanssen, Capt. H., of Spitsbergen Expedn., 1924..47
Hardy, A. C., of *Discovery* research expedn., 42
Harford, C. F., obituary, 287
———, F. D., new Member of Council, 9
Harper, C. G., London : Yesterday, To-day, and To-morrow, 262 §
Harrison, C., Ancient Warriors of North Pacific, etc., 554 §
Hasa, Wadi, Dead Sea Basin, 143
Hassanabad glacier, Himalaya, 333
Hassanein Bey, A. M., Lost Oases, 551 §
Hassasa, Wadi, Dead Sea basin, 140
Hassert, K., Australien und Neuseeland geographisch und wirtschaftlich, 461 §
Hastings, A. C. G., Nigerian Days, 363 §
Havell, E. B., Himalayas in Indian Art, 264 §
Hayden, Sir H. H., geol. work in Himalaya, 289 *et seq.* ; Journey in Cent. and S.E. Tibet, 377 § ; on Kashmir glaciers, 333
Hayford, J. F., death, 2 ; obituary by S. G. Burrard, 82
Heath River, Col. Fawcett's survey, 6
Heath, E. R., Honour to, 384
Heathcote, D., My Wanderings in Balkans, 451 §
Heawood, E., A new view of the Vespucci Problem, 339 *
Hebrides! Behold the, etc. : A. A. MacGregor, 548 §
Hecla Hook rocks, North-East Land, 19, 114–116
Hejaz and Trans-Jordan boundary, 149, 159
Helbig on early use of amber, 482
Helio-zincography, 535
Helm, O., on early Italian amber trade, 502
Hempel, J., on geology of oil-well area, Borysław, 425
Herdman, H. F. P., of *Discovery* research expedn., 42
Hernandez, J., on Temperature Conditions of Mexico, 176 §

Heron, Dr., geological work in Himalayas, 289 *et seq.*
Herrera and Vespucci's voyages, 342
Heru sultanate, Tanganyika Terr., 416–417, 418; hydrology, 411, 412
Hewitt: *see* Cavalier
Hildebrand, A. S., Magellan, 75 §
Hilwa, Wadi, Hejaz, 151
Himalaya, De Filippi Expedn.: T. G. L., 254 §; H— in Indian Art: E. B. Havell, 264 §; movements of glaciers in, 331 *
Himalayan flora, 398, 409; H—n gneiss, 294, 297
Hinarche glacier, Kashmir, 333
Hinks, A. R., Historic Instruments at Oxford, 43 *; Time Signals for Surveyors in the Field, 242 *
Hinlopen Strait, Spitsbergen, 19
Hinton, M. A. C., Rivers and Lakes: Story of their developmt., 170 §
Hisma plain, Hejaz, 152
Hispar glacier, 333
History, Geog. Introdn. to: L. Febvre, 562 §; Geography and H—: H. B. George, 373 §; Where Geography and H— Meet: W. L. Bunting, 373 §; Portolan Charts as Aid to H—: M. C. Andrews on, 478 §
Hobley, C. W., letter on Volcanoes and Isostasy, 89
Hoel, A., Research in Spitsbergen and Bear Id., 476 §; on recession of Spitsbergen glaciers, 26
Hogan, M. A., River Gauging, etc., 369 §
Hogarth, D. G., elected president, 9; proposes toast of Guests, 188
———, remarks on "Dead Sea to 'Aqaba," 157
Hojeda, Vespucci's voyage with, 441–442
Hollack, quoted, on early history of West Prussia, 503
Holland, Adventures of a Six-Tonner through, etc.: K. A. Coles, 357 §
Holtedahl, O., Ed., Report of Scientific Results of Norwegian Expedn. to Novaya Zemlya, 1921..168 §
Hombron Bluff, Papua, 523
Home, G., Through Chilterns to Fens, 358 §
Hope, S., Rolling Round World for Fun, 373 §
Hornby, A. J. W., on Vegetation, Climate and Agriculture in Nyasaland, 78 §
Horton, Eng.-Lieut. W. A., of *Discovery* research expedn., 42
Hot Springs, Origin, 80 §
Hotz, A. P. H., Hon. Corresponding Member, 75: gift of books to R.G.S. library, 7, 376
Hubbard, —, of Turco-Persian Boundary Commission, 234
Hufaiyira, Wadi, Dead Sea basin, 147
Hule, Lake, Jordan Valley, 528
Human Geography, Principles of: E. Huntington and S. W. Cushing, 72 §
Huntington, E., and S. W. Cushing, Principles of Human Geography, 72 §
Hur al Madal, Oman, 206
Husain, King of Hejaz, visit to Transjordan, 135 *et seq.*
Hutton, E., A Wayfarer in Unknown Tuscany, 449 §
Huwaitat Arabs, Hejaz, 150
Huxley, A., on decorative value of maps, 534

I.

Ibri, Oman, 210–211
Ice Dome, North-East Land, air drainage, 120
Idun, Mt., North-East Land, 22
Iffené, C. Africa, position, 351
Imperial Stocktaking: B. H., 257 §
im Thurn, Sir E., and L. C. Wharton, Journal of Wm. Lockerby, etc., 368 §
In Broken Water: K. A. Coles, 357 §
India, Lord Curzon's Posthumous Work on: R., 335 §
Indians, British, in Oman, 197
Indian Unrest, Study of Psychology of: Earl of Ronaldshay, 162 §
Instruments, Historic, at Oxford: A. R. H., 43 *
International Geographic Union at Cairo, 8
———— Map: Maj. M. N. Macleod, 445 *
Iraq, Heart of Middle East: R. Coke, 454 §
Iron Age, chronology, 503
Irrawady Delta, Aerophoto Survey and Mapping of: R. C. Kemp and others, 455 §
Irvine, A. C., death of, 3
Irwin, W., on Dead Sea salts, 144–146; Origin of Salts in Jordan, 527 *
Isis Pt., North-East Land, 25; geology, 115; magnetic observers, 129
Islands, West Indian and Ægean: Sir A. E. Shipley, 275 §
Isostasy, letter by A. Morley Davies, 90; and Volcanoes, letters by W. Werenskiold and C. W. Hobley, 89, 90
Italian Alps, Under: E. L. Broadbent, 449 §
Italy, early amber trade, 489, 496, 502; Seventeenth-century Maps, R. Almagià on, 172 §;
——, Northern, etc.: L. Bertarelli (Blue Guides), 358 §
——, Southern, Emigration from, Prof. P. de Bella on, 470 §;
——, and Balearic Isles, Story of Travel chiefly in: D. Goldring, 357 §
Itim, Wadi, Hejaz, 152
Iwasaki, Baron H., housing of Morrison Library, Tōkyō, 542, 544

J.

Jabrin, Oman, 213
Jacobsson, N., Per Lindeströms Resa till Nya Sverige 1653–1656..165 §

Jacot-Guillarmod, Charles, obituary, 479
Jahali, Oman, 208
Jaib, Wadi, Dead Sea basin, 146
Jalali Fort, Mascat, 194
James, H. G., Brazil after Century of Independence, 555 §
Jayakar, Col., on Oman natural history, 221
Jericho, spring at, 531, 533
Jesuit-Dominican Controversy in China, 544
Jeudwine, J. W., Religion, Commerce, Liberty, 1683–1793 .. 562 §
Jews and Phœnicians, 354
Jiri plain, Oman, 206, 219
Job Creek, W. Canada, 252
Johnson, Ven. W. P., My African Reminiscences, 66 §
Jones, B. M., and Maj. J. C. Griffiths, Aerial Surveying by Rapid Methods, 463 §
——, L. R., and P. W. Bryan, North America: Historical, Economic, and Regional Geography, II., 164 §
——, W. D., and D. S. Whittlesey, Introdn. to Economic Geography, 561 §
Jordan, Origin of Salts in: W. Irwin, 145, 527 *
——, stream, Lalibala, Abyssinia, 512
Jowasmi tribes, Oman, 205
Joyce, T. A., note on "Sierra Nevada of Santa Marta, Colombia," 111
Judæan mts., 143
Jumaila, Wadi, Hejaz, 151
Jungfrau, scenic effects, 428
Jurassic shales, Himalaya, 298–299
Jutland, early amber deposits, 484

K.

Kalahari, Pygmies and Bushmen of: S. S. Dornan, 364 §
Kampa beds, Himalaya, 298–299
Kanchenjhao, mt., Himalaya, 298
Kangaroo keeps on Talking: L. St. Clare Grondona, 271 §
Kangchenjunga, geology, 294
Kangshu g Glacier, Himalaya, 304, 305
Karakorum longitudinal glaciers, 304
Karkheh river, Arabistan, 230
Kartenwissenschaft: M. Eckert, 557 §
Kashgar Range, C. Asia, 386 *et seq.*
Kasulu district, Tanganyika Terr., 411–412, 416, 418
Katmai Erupns., Earth-movements during, C. M. Fenner on, 570 §
Kaying Bashi, Kashgaria, 396, 398
—— Beli, peak, Kashgar Range, 392–393
—— Jilgha, Kashgaria, 393–394
—— Valley, Kashgar Range, 397–398
Keable, R.: Tahiti, Isle of Dreams, 460 §
Keith, Sir A., Antiquity of Man, 171 §
Keltie, Sir J. S., and S. C. Gilmour, Adventures of Exploration, 373 §
Kemp, R. C., and others; Aerophoto Survey and Mapping . . . of Irrawady Delta, 455 §
——, S., of *Discovery* research expedition, 42
Kennedy, Sir A., on Petra ruins, 148
Kenya, Vanishing Tribes of: G. St. J. O. Browne, 65 §
Kepek pass, Kashgar Range, 399, 400
Kerr, A.: *see* Garrett, H. B. G.
Keun, O., In Land of Golden Fleece, 63 §
Khabra, Wadi, Dead Sea basin, 141
Khalkidikē, population, 321
Khan Bahadur Sher Jang, work on Turco-Persian Boundary, 232
—— Terek, Qaratash Valley, Kashgaria, 405
Khartoum and Marchand expedition, 348
Khushaiba, Wadi, Dead Sea basin, 141
Kibondo, Tanganyika Terr., hydrology, 411
Kikorogwi pool, Uha, Tanganyika Terr. 420–421
Kimana Deity, Uha, Tanganyika Terr., 421
"Kinama," position, Uha, Tanganyika Terr., 422
King, P., In Chinese Customs Service, 63 §
King's Bay glacier, Spitsbergen, 26
Kirumba Lake, Uha, Tanganyika Terr., 412
Klebs, quoted on early Jutland amber, 487
Klingenberg, Major, on Oslo, 77
Knocking about, etc.: *Ed.* Mrs. A. T. Leatherbee, 367 §
Koiari tribe, Papua, 526
Kök Döng, Shiwakte Mts., Kashgaria, 390, 394–395
Kolahoi glacier, Kashmir, surveys, 331–332
Kossinna, G., on Tryolese antiquity, 488
Kratzer, N., polygonal dial by, 43
Kulbus, C. Africa, position, 351
Kunaitara, Wadi, Dead Sea basin, 137
Kun Lun flora, 398
Kur river (Caspian), changes at mouth of, since 1829, Dr. Büdel on, 566 §
Kyebrak Glacier, Himalaya, 293, 297, 304, 311, 313

L.

La Baume, quoted, on History of West Prussia, 497
Labrador, Journeys by J. G. Thomas, 79 §
La Cosa, voyage with Vespucci, 441
Lagden, Sir G., Native Races of Empire, 257 §
Laguna Colorada, Puna de Atacama, F. C. Walcott on, 475 §
Lakes, Rivers, etc.: Story of their Development: M. A. C. Hinton, 170 §
Lalibala: R. McGrath, 507 *
Laloki river, Papua, 523–524
Lamna La, Himalaya, geology, 296

Lapche Kang (Munkri) range, Himalaya, geology, 300
Larsen, S., Discovery of North America Twenty Years before Columbus, 68 §
La Téne Period, chronology, 503
La Touche, T. H. D., on Sikkim glaciers, 334
Law, E., wireless operator, Oxford University Arctic Expedition, 11, 38
Lawrence in Arabia, With: L. Thomas, 359 §
Lawson, A. C., on Californian Continental Shelf, 568 §
Leatherbee, Mrs. A. T., *Ed.* Knocking about, etc., 367 §
Lee, I. (Mrs. C. B. Marriott): Early Explorers in Australia, 69 §
Leeward Ids., Handbook of: F. H. Watkins, 460 §
Lenz, Oscar, obituary, 180
Lepe, D. de, and Vespucci's voyages, 342
Lettera of Vespucci, 339 *et seq.*
Lettland, Finnland und Litauen: M. Friederichsen, 450 §
Lewin, E., Resources of Empire and their development, 257 §
Lewis, Maj. C. G.: *see* Kemp, R. C.
Lewis Evans Collection of Historical Scientific Instruments, Oxford, 43
Liberty, Religion, Commerce, 1683–1793: J. W. Jeudwine. 562 §
Library, A Great Oriental: W. W., 542
Liefde Bay, Spitsbergen, 15; magnetic observns., 129; meteorology, 126
Lindquist, G., of Spitsbergen Expedn., 1924..37
Lindeströms Resa till Nya Sverige, 1653–1656: N. Jacobsson, 165 §
Lingtren peaks, Mt. Everest region, 306
Lishan, T., on Ethiopian troglodytes, 511
Litauen, Finnland, Estland und Lettland: M. Friederichsen, 450 §
Lithography, 534
Livingstone, Dr., discovers relic at Pim Id., Smith Sound, 539 *et seq.*
———, etc.: H. Walton, 364 §
Lockerby, William, Journal of, etc.: *Ed.* Sir E. im Thurn and L. C. Wharton, 368 §
Logan, Mt., Expedn., 6; A. H. MacCarthy on, 178
Lombardy, Tyrol and Trentino: H. Quigley, 449 §
London: S. Dark, 59 §; L— Life in Fourteenth Century: C. Pendrill, 262 §; L— Yesterday, To-day and To-morrow: C. G. Harper, 262 §
——— Conference on Intern. Map, 445
Longstaff, T. G., remarks on "Sierra Nevada of Santa Marta, Colombia," 108
Lost Oases: A. M. Hassanein Bey, 551 §
Low Id., North-East Land, 21; geology, 115
Luasa, Uha, Tanganyika Terr., 422
Lubbock, B., Adventures by Sea from Art of Old Time, 276 §
Lucas, Sir C., Empire at War, 559 §; Story of Empire, 257 §
Luguru sultanate, Tanganyika Terr., 416–417
Lyde, L. W., and C. M. Butterworth, From Pole to Pole, 373 §

M.

MacAlister, D. A., on Ancient Mines in Egypt, 576
MacCarthy, A. H., on Mt. Logan Expedn., 178
Macedonia, racial problems, 317 *et seq.*
McGrath, R., Lalibala, 507 *
MacGregor, A. A., Behold the Hebrides! etc., 548 §
MacHinton, —, on "salt licks" in Tanganyika Terr., 414
Mackinder, Sir H., Nations of Modern World, 375 §
Mackintosh, N. A., of *Discovery* Research Expedn., 42
McLaren, W. A., Resources of Empire: Rubber, Tea, Cacao, and Tobacco, 258 §
MacLeod, Major N. M., International Map, 445 *
McLeod river, W. Canada, identification, 249
McMahon, Gen. C. A., on Himalayan "Augen Gneiss," 294, 297
Macmillan Arctic Expedn., 382
Macnie, Capt. J., Work and Play in Argentina, 365 §
Macotama, *paramo* of, Colombia, 104
Madane Alam church, Lalibala, Abyssinia, 513
Magdalena Province, Colombia, 97
Magellan: A. S. Hildebrand, 75 §; Vespucci's influence on his voyage, 342
Magnaghi, A., Amerigo Vespucci, etc.: E. H., 339 §
Mahadha, Jabal, Oman, 206
Mahras, Wadi, Dead Sea basin, 141
Malcolm inlet, Oman coast, 198
Malih, 'Ain, salt spring, River Jordan, 145
Mallory, G. L., death of, 3
Malmignati, Countess, Through Inner Deserts to Medina, 452 §
Man, Antiquity of: Sir A. Keith, 171 §
Mandate, Palestine of: W. B. Worsfold, 453 §
Manington, G., West Indies, 457 §
Maori, The: E. Best, 270 §
Map, International: Maj M. N. Macleod, 445 *
——, Wall, of British Empire, 478 §
Map-making, 533 *et seq.*
Maps, artistic aspect, 533
Maqta tidal creek, Oman, 201
Marbut, C. F.: *see* Shantz, H. L.
Marchand expedn. and Khartoum, 348
Marchi, L. de, Fondamenti di Geografia Commerciale, 73 §

Marcoyos church, Lalibala, Abyssinia, 513
Mariam church, Lalibala, Abyssinia, 514
Markham, Admiral Sir A., on Queen Victoria's gifts to Arctic Voyagers, 540
Marmer, H. A., on Variations of Sea-level on the Atlantic Coast of United States, 380 §
Marquez, L. C., Columbian Minister, remarks on "Sierra Nevada of Santa Marta," 106
Marriott, Mrs. C. B.: *see* Lee, I.
Martin, James, obituary, 86
Martonne, E. de, Hon. Corresponding Member, 75
Mason, Maj. K., Notes on compilation of Mr. C. P. Shrine's Topographical Material in neighbourhood of Qungur Massif, 407; quoted on height of Qungur, 386
———, J. C. B., of Spitsbergen Expedn., 1924..37
Mass and volume in scenic effects, 433
Matterhorn, scenic effects, 428–429, 432
Matthews, L. H., of *Discovery* research expedn., 42
Mawer, A., and F. F. M. Stenton, Place-names of Buckinghamshire, 547 §
Medals and Awards, Presentation of, 92–94
Medici, L. de, Vespucci letter to, 339 *et seq.*
"Medicine," place-name in W. Canada, 250
Mediterranean Lands, etc.: Miss M. I. Newbigin, 352 §
———— Sea, salinity, 531–532
———— and Dead Sea hydrology, 145
Meek, C. K., on derivation of name "Niger," 176
Meinesz, A. E. V., work on gravity at sea, 8
Menace of Colour: J. W. Gregory, 273 §
Merani Fort, Mascat, 195
Merki pass, Kashgar Range, 388–389
Merry del Val, A., Spanish Ambassador, responds to toast of Guests, 191
Mesopotamia, Boundary Commission in 228 *et seq.*
Mexico, Temperature, J. Hernandez on, 176 §
Meyer, A. B., quoted on amber antiquities, 482; on chemistry of amber, 501
Midian, gold in ancient, 153
Miles, Col., journeys in Oman, 194, 212–213, 214, 218, 219, 221, 226
Military Geography, Conditions Géographiques de la Guerre: Capt. R. Villate, 559 §
———— Uses of Astronomy: F. C. Molesworth, 169 §
Millais, J. G., Far away up Nile, 65 §
Miller, O. M., Aid to Triangulation, 271 §
———, W. H., on Southesk's route in West Canada, 249 *et seq.*
Miller's 'Itineraria Romana' quoted, 498
Milner, Right Hon. Viscount, K.G., obituary, 88
Mills, J. S., Press and Communications of Empire, 257 §
Minipin glacier, Himalaya, 333
Minorsky, M., Russian Commissioner for Turco-Persian Boundary, 234
Misakin plain, Oman, 206
Mischelbach, Franconia, antiquities, 488
Missionary Atlas, World: *Ed.* H. P. Beach and C. H. Fahs, 371 §
Mitchell, B. W., Trail Life in Canadian Rockies, 457 §
———, J. W. A., on Pindari Milam glacier, Kumaon, 334
Mjelde, M. M., Eyktarstad-problemet og Vindlandsreiserne, 53 §
Mlagarasi river, Uha, Tanganyika Ter., 411; valley, 418
Moab, Mts. of, 143
Moberly, H. J., travels in W. Canada, 247 *et seq.*
Mohn, Cape, North-East Land, 24
Molesworth, F. C., Military Uses of Astronomy, 169 §
Monmarché, M.: *see* Muirhead, F.
Montague, F. A., of Spitsbergen Expedn., 1924..37; on birds of Spitsbergen, 113
Mont Blanc: R. Tissot, 358 §
Montell, Col. P. L., Souvenirs vécus, 344 §
Montelius, O., on early European culture and amber trade, 481 *et seq.*
Moravian amber finds, 489
Moray Firth Coast, Physiography, A. G. Ogilvie on, 279 §
Morrison, G. E., library at, Tokyo, 542
Moses, tomb of, 135, 137
Moslem invasion of Abyssinia, 508
Moslems in Macedonia, 318 *et seq.*
Mosquito Banks and Sargasso weed, 437
Mosso, O., quoted on amber in Crete, 483
Motor Tractors for Antarctic Exploration, 442*
Moye, lake, Uha, Tanganyika Terr., 412
Mteko or Mtwale, judge, Uha, Tanganyika Terr., 420, 421
Mugandazi valley, Tanganyika Terr., 418
Mugera Hill, Uha, Tanganyika Terr., 421
Muhlberg, M., Geographical Methods as applied to oil-finding: *see* Stigand, I. A.
Muirhead, F., *Ed.* Blue Guides, 358 §
———— and Monmarché, M., Brittany and Normandy (Blue Guides), 358 §
————, J. A. O., Readable Physical Geography, 373 §
Mundus Novus, of Vespucci, 339 *et seq.*
Munro, quoted on Lake Dwellings, 495
Murchison Grant to E. Teichman, 93
Murray, Sir J., and J. Chumley, on Deep-sea Deposits of Atlantic, 283 §
Muscat, Oman, 194 *et seq.*
"Music of the Sands," Oman, 202

Muzimu lake, Uha, Tanganyika Terr., 412
Muz Tagh Ata, Kashgar Range, 386
Myres, J. L., remarks on "Prehistoric Routes, etc., defined by Amber Trade," 504

N.

NAIM tribe, Baraimi oasis, Oman, 207
Nansen, F., quoted on amber at Corinth, 483; Hunting and Adventure in Arctic, 462 §
Nares Arctic Expedn. and relic at Pim Id., 539 *et seq.*
Nash, W. G., America: True History of Discovery, 269 §
Nations of Modern World: Sir H. Mackinder, 375 §
Navarro, J. M. de, Prehistoric Routes between Northern Europe and Italy defined by Amber Trade, 481 *
Navy League and Wall Map of British Empire, 478 §
Neve: *see* Cavalier
——, E. F., on Kolahoi Glacier, Kashmir, 333
Newbigin, Miss M. I., Mediterranean Lands, etc., 352 §
New Sweden. Per Lindeströms Resa till Nya Sverige, 1653–1656.. 165 §
New Zealand. Australien und N— geographisch und wirtschaftlich: K. Hassert, 461 §; Soundings in Sea round, H. T. Ferrar on, 571 §
————, Sterbende Welt. Zwölf Jahre Forscherleben auf Neuseeland: A. Reischek, 461 §; Vegetation of N—Z—: L. Cockayne, 166 §
Ngoro, Ushingo Mts., Tanganyika Terr., 421
Niagara, Power from, S. S. Wyer on, 380 §
"Nieve penitente" on Mt. Everest glaciers, 310
"Niger," Derivation of Name, C. K. Meek on, 176; Touareg du N—: Les Oulliminden, 456 §
Nigerian Days: A. C. G. Hastings, 363 §
Nile, Far away up: J. G. Millais, 65 §; N— Mud in Upper Sudan, Depth of, Lt.-Col. C. R. K. Bacon on, 479
Niles, B., Colombia, Land of Miracles, 555 §
Nizwa, Oman, 214, 215
Nordenskiöld, Baron A. E., Account of interior of North-East Land, Commentary, 38; on Spitsbergen geology and glaciology, 116, 118; sledge journey in North-East Land, 10; traverse in same, 26
Normandy (Blue Guides): F. Muirhead and M. Monmarché, 358
Norwegian Expedn. to Novaya Zemlya, 1921, Report of Scientific Results: *Ed.* O. Holtedahl, 168 §
———— Research in Spitsbergen and Bear Id., Dr. Hoel and others, 476 §
North-East Land, Spitsbergen, 9 *et seq.*, 111 *et seq.*; Commentary on Nordenskiöld's account, 38; birds of, 113; history, 10
North Col., Mt. Everest, glaciology, 303 *et seq.*
Norton, Col., work in Himalayas, 4
Novaya Zemlya, Rept. of Scientific Results of Norwegian Expedn.: *Ed.* O. Holtedahl, 168 §
Nukhbar, Wadi, Dead Sea basin, 141
Numelin, R., on Finland, 280 §
Nunn, G. E., Geographical Conceptions of Columbus, etc., 465 §
Nyasaland, Vegetation, Climate and Agriculture in, F. Dixey, J. B. Clements, and A. J. W. Hornby on, 78 §

O.

OASES, Lost: A. M. Hassanein Bey, 551 §
Obermaier, H., Fossil Man in Spain, 355 §
Oceans, Origin of Continents and: A. Wegener, 70 §
O'Connor, Lt.-Col. W. F., letter on Spelling of Tibetan, 287
————, Lt.-Comm. W. H., of *Discovery* research ship, 42
Odell, N. E., Observns. on Rocks and Glaciers of Mt. Everest, 298 *
Ogilvie, A. G., Physiography of Moray Firth Coast, 278 §
Oilaud, ship of Oxford University Arctic Expedn., 11
Oil-wells, temperature in, 422
Okdat, Jebel, Oman, 208–209, 226–227
Oldham, R. D., on gneiss, 297; remarks on "Rocks and Glaciers of Mt. Everest," 314
Olshausen, quoted on early Jutland amber, 487
Olufsen's Sahara Expedn., 1922–1923.. 553 §
Oman, Some Excursions in: Maj.-Gen. Sir P. Cox, 193 *
Omanis in Portuguese East Africa, 215
O'Neill, H. E., obituary, 286
Oprang river, source, 256
Ordnance Survey, Recent Productions: Capt. J. G. Withycombe, 533 *
Organic Adaptation to Environment: *Ed.* M. R. Thorpe, 74 §
Oriental Library, A Great: W. W., 542 *
Ormond, P. S., Basques and their Country, 548 §
Oslo, Major Klingenberg on, 77
Oxford, Historic Instruments at: A. R. H., 43 *; University Arctic Expedition: F. G. Binney, 9 *, 111 *

P.

PACIFIC. Green Islands in Glittering Seas: W. L. Puxley, 167 §; North P—, Ancient Warriors, etc.: C. Harrison, 554 §; Threshold of P—, etc.: C. E. Fox, 366 §

Palestine. Dead Sea to 'Aqaba: H. St. J. B. Philby, 134 *; Names in, 175; P— of Mandate: W. B. Worsfold, 453 §
Palgrave on Jebel Okdat, Oman, 226
Pallis, A. A., Racial Migrations in Balkans, 1912–1924..315 *
Palomino, river and town, 105
Panoramic effect in scenery, 432
Papuan Headhunters, Among: E. B. Riley, 556 §
Paris Conference on Internat. Map, 445 *et seq.*
Parkes, J., Travel in England in Seventeenth Century, 355 §
Parry, Sir E., expedn. to Spitsbergen, 10
———, R. E., British Isles, 373 §
Pascoe, E. H., work on Himalayan glaciers, 333; on synclinal valleys in Himalaya, 301
Patron's Medal to A. F. R. Wollaston, 93
Pearl fishery in Persian Gulf, 199
Pearson, Col., British Boundary Mission, C. Africa, death of, 351
Peirce, Augustus Baker, Adventures of, in Australia, 367 §
Pekin, Walls and Gates: O. Sirén, 163 §
Pelly, R. G.: *see* Bolton, E. R.
Pendrill, C., London Life in Fourteenth Century, 262 §
Penzer, N. M., Resources of Empire: Non-ferrous Metals, 259 §
Pereira, Gen. G., death, 5
Persian Gulf pearl fishery, 199
———, Turco-, Boundary Demarcation in 1913–14, Col. C. H. D. Ryder, 91 (*title only*), 227 *
Peschiera, Lake Garda, antiquities, 488
Petra ruins, Sir A. Kennedy on, 148
Petroleum, Outlines of Occurrence and Geology, I. A. Stigand, 72 §; P— in Uganda: E. J. Wayland, 362 §
Philby, H. St. J. B., new Member of Council, 9; on salts of Jordan, 527 *et seq.*; Dead Sea to 'Aqaba, 134 *; remarks on "Some Excursions in Oman," 222
Philip, G., and Son, Wall Map of British Empire, 478 §
———, and T. S. Sheldrake, Chambers of Commerce Atlas, 563 §
Phipps, Capt., expedn. to Spitsbergen, 10
Phœnician history, 354
Phusi La, Himalaya, geology, 293; erratic on, 311–312, 313
Physical Geography, Readable: J. A. O. Muirhead, 373 §
Pim Id., Smith Sound, relic at, 539
Pindari Milam, glacier, Kumaon, 334
Pierpoint, Capt., of Turco-Persian Boundary Commission, 234
Plankton collector, Hardy's, 42
Pocock, T. I., on River-terraces and Glacial Drifts of Welsh Border, 565 §
Polar Bjorn, ship of Oxford University Arctic Expedn., 11
Polar Climates, Theory of, C. E. P. Brooks on, 572 §; Thermal Characteristics, C. H. Pollog on, 282 §
Polar Flight, Amundsen's, 48 *
Pollog, C. H., on Thermal Characteristics of Polar Climates, 282 §
Polo, Marco, Travels of, in new Tokyo library, 543
Polygonal surface markings in Himalaya, 310
Ponsonby, Sir F., on alleged gift of Queen Victoria to officers of Nares Arctic expedn., 541
———, Rev. S. G., proposes vote of thanks to President and Council, 95
Porteous, A. N., of *Discovery* research expedn., 42
Portolan Charts as aid to History, M. C. Andrews on, 478 §
Poting glacier, Kumaon, 334
Practical Astronomy, etc.: G. L. Hosmer, 465 §
Prehistoric Forerunners, Our: C. E. Vulliamy, 272 §
Prestwich on geothermic data, 425
Price, A. G., Foundation and Settlement of S. Australia, 1829–1845..460 §
Priestley, R. E., ice zones, 116
Prussia, West, early amber trade in, 497
Ptolemy's Taprobana, goal of Vespucci, 343
Pueblo Viejo, Colombia, 101
Puri-puri magic, Papua, 526
Puxley, W. L., Green Islands in Glittering Seas, 167 §
Pygmies and Bushmen of Kalahari: S. S. Dornan, 364 §

Q.

Qaratash gorge and river, Kashgar Range, 386 *et seq.*
Qirghiz settlements, 390 *et seq.*
Qizil Tagh, Kashgaria, 396
Queen Charlotte Islands, Historical Account of: C. Harrison, 554 §
Quigley, H., Lombardy, Tyrol and Trentino, 449 §
Qungur, Alps of: C. P. Skrine, 385 *

R.

Racial Migrations in Balkans, 1912–1924: A. A. Pallis, 315 *
Radio Communication Co. and Oxford University Arctic Expedn., 11
Raffray, A., visit to Lalibala, 509 *et seq.*
Raglan, Lord, remarks on "Dead Sea to 'Aqaba," 158
Rainfall Variations and Tropical Development, S. S. Visher on, 477 §
Rain-water, salinity, 530
Rancheria, Rio (Calancala), Colombia, 100
Rankin, A. N. T., of Spitsbergen Expedn., 1924..37; bird photography in Spitsbergen by, 113
Ras al Khaima, Oman, 205

Rasmussen, K., Fifth Thule Expedn., etc., 576 (*title only*)
Rawlinson, Lord, death of, 2
Reading, Earl of, proposes toast of R.G.S., 180
Reindeer Peninsula, Spitsbergen, 15; ecological work at, 112
Reischek, A., Sterbende Welt. Zwölf Jahre Forscherleben auf Neuseeland, 461 §
Reisenberg, F., Under Sail: voyage round Cape Horn, 275 §
Relf, E., of Spitsbergen Expedn., 1924; 37; Appendix V., Magnetic Observations, 127 *; Appendix VI. Wireless, 129 *
Religion, Commerce, Liberty, 1683–1793: J. W. Jeudwine, 562 §
Rep, islands charted by, along coast of North-East Land, 25
Reutter, Dr., on chemistry of amber, 495, 501
Rice, H., Expedn. to Rio Branco, 5, 46*
Richer, A., Les Touareg du Niger: Les Oulliminden, 456 §
Ried, Upper Inn Valley, amber finds, 487
Riley, E. B.: Among Papuan Headhunters, 556 §
Rimu glacier basin, Karakoram, 254 *et seq.*
River Gauging, etc.: M. A. Hogan, 369 §
Rivers and Lakes: Story of their Development: M. A. C. Hinton, 170 §
Riviera, scenic effects, 429
Robbins, C. R.: *see* Kemp, R. C.
Roberts, S. H.: History of Australian Land Settlement, 1788–1920..367 §
Robinson, Capt. B. W.: With Shot Gun and Rifle in North American Game Fields, 457 §
Rockies, Canadian, Trail Life in: B. W. Mitchell, 457 §
Rodd, F., Origin of Tuareg, 576 (*title only*)
——, Sir R., French Soldier Explorer in Africa (Monteil), 344 §; Introdn. to 'Lost Oases': A. M. Hassanein Bey, 551 §
Rohlfs' visit to Lalibala, 509, 511
Rolling Round World for Fun: S. Hope, 373 §
Roman Britain, Last Age of: E. Foord, 548 §
—— civilization, 354
Rome (The Little Guides): C. W. Ellaby, 358 §
Rymer, E., Hon. Corresponding Member, 75
Ronaldshay, Lord, Address at Anniversary Meeting, 1925..1*; Heart of Âryâvarta, 162 §; remarks on "Alps of Qungur," 410; on "Dead Sea to 'Aqaba," 155, 159; on "Oxford University Arctic Expedn.," 133; on "Prehistoric Routes, etc., defined by Amber Trade," 503, 507; on "Rocks and Glaciers of Mt. Everest," 313, 315; on "Some Excursions in Oman," 221; responds to toast of R.G.S., 183
Rongbuk Glacier, geology, 291; retreat, 302; R— G—, East, trough of, 307–309
Rongshar region, Himalaya, geology, 293, 313
Roth, H. Ling, obituary, 87
Rouna Falls of Papua: T. J. L. Dowsett, 522 *
R.G.S., Address at Anniversary Meeting, 1925: Lord Ronaldshay, 1*; Anniversary Dinner, 180; *Journal*, Gen. Index to, vols. 21–40, 278 §; Library, Generous Gift to, 376; Medals, etc., presentation of, 92–94; Meetings and Elections, 91..576; Special General Meeting, 91; R.G.S. and Internat. Map, 445–446; and Oxford University Arctic Expedition, 11
Ruchugi valley, Tanganyika Terr., 418
Ruhinda of Ushingo, Sultan, Tanganyika Terr., 415, 416
Ruli La, Himalaya, geology, 300–301
Russia, Art Treasures in Soviet: Sir M. Conway, 263 §
Rutter, O., New Baltic States, 449 §
Ruus al Jibal Coast, Oman, 198
Ryan, M. F., ascent of Aconcagua, 44 *et seq.*
Ryder, Col. C. H. D., new Member of Council, 9; Demarcation of Turco-Persian Boundary, 91 (*title only*), 227 *

S.

Sabaga swamp, Uha, Tanganyika Terr., 412
Sabine, Cape, Smith Sound, Nares Expedn. at, 540
Sa'diyin tribe, Dead Sea basin, 147
Sahara, Le (Collection Payot): E. F. Gautier, 268 §; Olufsen's Expedn., 1922–1923..553
Saifam, Oman, 213
St. George, Lalibala legend of, 512
St. Lawrence, Great Lakes Deep Waterway, R. E. Freeman on, 380 §
Saiq, Oman, 218
Salaif, Oman, 212
Salmon, A. L., Bristol: City, Suburbs and Countryside, 162 §
Salonika, Jewish population, 323
Salt, H., on Lalibala, 509, 511
——, Maj. A. E. W., Military Geography of British Commonwealth, 468 §
Salt Lake "Oasis," Utah, L. White on, 474 §
Salts in Jordan, Origin of: W. Irwin, 527 *
Samye Monastery, Tibet, 519–520
San Cristoval, Solomon Ids., Social Organization, Magic and Religion of People of: C. E. Fox, 366 §
Sandford, K. S., of Spitsbergen Expedn., 1924..37; glaciological work in North-

East Land, 22; Oxford University Arctic Expedn., 1924, Appendix II. Geology and Glaciology, 114 *
San Lorenzo range, Colombia, 98
San Miguel, Colombia, 102
Santa Marta, Colombia, harbour and town, 93; Sierra Nevada of S— M—: A. F. R. Wollaston, 97 *
Sapper, K., Allgemeine Wirtschafts- und Verkehrsgeographie, 469 §
Sargasso Sea: Capt. C. C. Dixon, 434 *
Sarigh Yon, Shiwakte Range, 399
Savile, F., River of the Giraffe, 364 §
Scenery, Natural, Apparent Magnitude in, and its Determining Causes: V. Cornish, 427 *
Sciences Géographiques, Les: C. Vallaux, 73 §
Schmidt, H., of Spitsbergen Expedn., 1924..37
Schöner, J., German Cartographer, and Vespucci, 343
Schönken, J. O., on South African Drought, 567 §
Schránil, on Aunjetitz Period, 500; on Bohemian antiquities, 485–486
Schumacher, on early "amber routes," 494
Scotland, Ordnance Maps, 535
Scott, Lieut. C. A., Position of Baraima, Oman, determined by, 204
——, C. W.: *see* Kemp, R. C.
——, Capt. R. F., and Antarctic tractors, 444; and Companions, Memorial to, 285
Schurz, W. L., on Population of Amazon Basin, 379 §
Sea, Adventures by, from Art of Old Time; B. Lubbock, 276 §
——. its History and Romance: F. C. Bowen, 276 §
——, Ship and Sailor, etc.: Capt. E. Snow, 563 §
Sea-level Variations on Atlantic Coast of U.S.A., H. A. Marmer on, 380 §; S— L— and Tides, Meteorological Perturbations, A. T. Doodson on, 283 §
Sea-plane, in Oxford University Arctic Expedn., 15–16, 18
Seger, H., on Aunjetitz period, 500; quoted on Glatz Pass, trade route, 498; on amber in Silesia, 500
Seir, Mt., Palestine, 144, 147, 150, 152
Seton-Karr, H. W., on Ancient Mines in Egypt, 473, 576
Severn Valley, scenic effects in, 428
Shakir, Amir of Transjordan, 136, 139
Shan Kulpa, glacier, Kumaon, 334
Shansi, Shantung, etc., Story of Baptist Mission in: E. W. Burt, 549 §
Shantz, H. L., and C. F. Marbut, Vegetation and Soils of Africa, 552 §
Sharaija, Oman, 218
Sharja, Jowasmi principality, Oman, 206
Shaw, Capt. A. R. P., on Changes in Crete, 278 §
Shayok river, source, 255
Sheldrake, T. S.: *see* Philip, G.
Shensi, etc., Story of Baptist Mission in: E. W. Burt, 549 §
"Shihuh" tribe, Hanjam Id., Oman, 199
Shipley, Sir A. E., Islands, West Indian and Ægean, 275 §
Shire Valley, Nyasaland, F. Dixey on, 472 §
Shiwakte Mts., Kashgaria, 385 *et seq.*
Shropshire Place-names: E. W. Bowcock, 545 §
Siachen glacier, Karakoram, 254, 256
Siam, Highest Mountain in, Ascents by H. B. G. Garrett and A. Kerr, 565 §
Sicilian amber deposits, 482, 496
Sierra Nevada of Santa Marta, Colombia: A. F. R. Wollaston, 97 *
Silchester, Book of: J. Thomson, 57 §
Silesian amber finds, 489
Simons, F. A. A., map of Sierra Nevada, Colombia, 98
Sinai, Mt., Hejaz, 153
Singh, R., attempt to traverse Qaratash valley, Kashgar Range, 387
Sir plain, Oman, 206
Siren, O., Walls and Gates of Pekin, 163 §
Sixty Years Ago, etc.: A. H. Gray, 277
Skelton, Admiral, on motor tractors for Antarctic use, 443
Skerl, J. G. A., Transl. of 'Origin of Continents and Oceans': A. Wegener, 70 §
Skrine, C. P., Alps of Qungur, 385 *
Smith, D. H., Economic Geography of Europe, 373 §
——, G. E., Pref. to Threshold of Pacific, etc.: C. E. Fox, 366 §
——, Leigh, on position of Cape Mohn, North-East Land, 24; surveys of North-East Land, 10
——, P. S., on North-Western Alaska, 282 §
——, W. C., on hydrology and geology of Uha, Tanganyika Terr., 411–412, 414
Snow, Capt. E., Sea, Ship, and Sailor, etc.: 562 §
——, E. C., Resources of Empire: Leather, 259 §
Socotra fishermen, 195
Soderini, Vespucci's letter to, 339 *et seq.*
Sohar, Oman, 198
Sölch, J., Geographischer Führer durch Nordtirol, 357 §
Soley, Comm., on Sargasso Sea, 437
Solomon's quarry, Jerusalem, 532
Sonapani glacier, Lahaul, 333
Southesk's Journey through the West of Canada, 246 *
Souvenirs vécus: Col. P. L. Monteil, 344 §
Soviet Russia, Art Treasures in: Sir M. Conway, 263 §
Spain, Fossil Man in: H. Obermaier, 355 §
Spence, L.: Atlantis in America, 466 §
Spitsbergen as base for polar flight, 52;

Beschryvinghe van Samoyeden Landt en Histoire du Pays nommé S—: H. Gerritsz, 556 §; biology and climate, 111–113; geology and glaciology, 114; glacier recession, 26; Oxford Expedn., 5, 9 *et seq.*; Russo-Swedish Arc of Meridian Expeditions, 10
Spitsbergen and Bear Id., Research in, Dr. Hoel and others, 476 §
Spittel, R. L., Wild Ceylon, 455 §
Stählin, F., Das hellenischen Thessalien, 450 §
Stanley's visit to Uha, Tanganyika Terr., 415
Stanpoint tractors, 444
Stein, Sir A., first Asia Lecture, 6; topographical work in C. Asia, 407–409; traverse of Quaratash valley, Kashgar mts., 387
Stenhouse, Comm. J. R., of *Discovery* research expedn., 42
Stenton, F. F. M.: *see* Mawer, A.
Stephenson, W. T., Resources of Empire: Communications, 259 §
Sterbende Welt. Zwölf Jahre Forscherleben auf Neuseeland: A. Reischek, 461 §
Stiffe, Capt. A., on history of Fort Jalali, Mascat, 195
Stigand, I. A., Occurrence and Geology of Petroleum, 72 §
Stonborough, T., of Spitsbergen Expedn., 1924..37
Stonyhurst Boy in Many Lands, Wanderings of a: A. H. Gray, 277 §
Stor Id., North-East Land, 25
Storm, G., on Wineland azimuth problem, 53 *et seq.*
Sudan— River of Giraffe: F. Savile, 364 §; S— Survey Department, Annual Report, 1924: A. A. R. Boyce, 160 §; Western Frontier: C. F. Close, 349 §
Sultans' funeral rites, Uha, Tanganyika Terr., 419–420
Sun Compass, 129
Surveying, Aerial, by Rapid Methods: M. M. Jones and Maj. J. C. Griffiths, 463 §
Surveyors in Field, Time Signals for: A. R. Hinks, 242 *
Sutherland, D., Shore Vegetation of Wigtownshire, 76 §
Synclinal valleys in Himalaya, 301
Szombathy, J., quoted, on amber antiquities, 482

T.

TAHITI: Isle of Dreams: R. Keable, 460 §
Tanganyika Territory, Uha in, Capt. C. H. B. Grant, 411 *
Tanuf, Oman, 216
Taprobana of Ptolemy, goal of Vespucci, 343
Tarim basin, dust haze, 390
Taylor, Capt. J. C., of Spitsbergen Expedn., 1924..37
Teichman, E., Murchison Grant to, 93
Tennant, Col. J. E., of Spitsbergen Expedn., 1924..37
Terek Kichik, Qaratash valley, Kashgaria, 405
Thasos, population, 321
Theodolite, first, 43
Theophrastus on Ligurian amber mines, 496
Thessalien, Das hellenische. F. Stählin, 450 §
Thomas, J., Asia, 373 §
———, J. G., Journeys in Labrador, 79 §
———, L., With Lawrence in Arabia, 359 §
Thomson, J., Book of Silchester, 57 §
Thornycroft, R., of Spitzbergen Expedn., 1924..37
Thorpe, M. R., Organic Adaptation to Environment, 74 §
Thrace, racial migrations in, 326 *et seq.*
Thule Expedn., Fifth, etc.: K. Rasmussen, 576 (*title only*)
Tib river, Arabistan, Iraq, 232
Tiberias, hot spring near, 531–532, 533
———, Lake, hydrology, 528
Tibet Past and Present: Sir C. Bell, 59 §; Hayden's Journey, 377 §; ice-sheet of Plateau, 312–313
Tibetan, Spelling of, Lieut.-Col. W. F. O'Connor on, 287
Tidal Waves, C. Vallaux on, 382 §
Tides, Meteorological Perturbations of Sea-level and, A. T. Doodson on, 283 §
Tien Shan flora, 398, 409
Tigarman Su Jilgha, Kashgar Range, 403
Tigris, My Journey down: S. Guyer, 62 §
Time Signals for Surveyors in Field: A. R. Hinks, 242 *
Tirol — Geographischer Führer durch Nordtirol: J. Sölch, 357 §; Tyrol, Lombardy and Trentino: H. Quigley, 449 §
Tissot, R., Mont Blanc, 358 §
Toil, Mt., North-East Land, 21
Tokyo, Oriental Library at, 542 *et seq.*
Tone, gradation of, in landscape, 427
Torday, E., On Trail of Bashongo, 64 §
Torlosa, Mt., Andes, 45
Tornau, F., on geology of Uha, Tanganyika Terr., 414
Tractors, Motor, for Antarctic Exploration, 442 *
Trans-Jordan camel corps, 146
———— and Hejaz boundary, 149, 159
Travel, Story of, etc.: D. Goldring, 357 §
Travellers, Practical Hints to Scientific, *Ed.* H. A. Brouwer, 468 §
Trentino, Lombardy, Tyrol and: H. Quigley, 449 §
Triangulation, Aid to: O. M. Miller, 271 §
Treurenberg Bay, North-East Land, 34
Trinkler, E., Journey in Afghanistan, 175 §
Tropical Developmt., Variations in Rainfall, etc.: S. S. Visher on, 477 §

Trotter, Sir H., and height of Qungur 386, 408
Trucial Coast ports, Oman, 200
Tsangpo river, exploration, 5; Note on Portion of: Maj. F. M. Bailey, 519;* Through the Gorge of: F. K. Ward, 91 (*title only*)
Tuareg, Origin of: F. Rodd, 576 (*title only*); Touareg du Niger: Les Oullimiden: A. Richer, 456 §
Tudela, Benjamin of, Travels in Western Asia, P. Borchardt on, 78 §
Turco-Persian Boundary in 1913–14, Demarcation: Col. C. H. D. Ryder, 91 (*title only*), 227 *
Turkish burial customs, 150; T— Migrations, 315 *et seq.*
Turrill, W. B., Note on plants collected by Mr. Skrine, 409
Tuscany, a Wayfarer in: E. Hutton, 449 §
Tymms, Capt. F., of Oxford University Arctic Expedition, 11, 37; Aerial Navigation in Arctic, 126*; Oxford University Arctic Expedn., 1924: Appendix III. Meteorology, 120

U.

UGANDA, Petroleum in: E. J. Wayland, 362 §
Uha in Tanganyika Territory: Capt. C. H. B. Grant, 411 *
Umm al 'Idan, Wadi, Dead Sea basin, 146
Underwood, J. J., Alaska: Empire in making, 555 §
United States, Variations of Sea-level on Atlantic Coast of: H. A. Marmer on, 380 §; U.S. and Internat. Map, 380 §
Usdam, Jabal (Mt. of Sodom), Dead Sea, 141
Ushingo sultanate, Tanganyika Terr., 416–417

V.

VACCHELLI, Gen. N., Hon. Corresponding Member R.G.S., 75
Vaglienti documents on Vespucci, 339 *et seq.*
Vallaux, C., on "Tidal Waves," 382 §; Les Sciences Géographiques, 73 §
Van Keulen, chart of east coast of North-East Land, 25
Vespucci Problem, New View of: E. H., 339 *
Viceroys and Government Houses: Marquis Curzon of Kedleston, 335 §
Victoria, Queen, and relic at Pim Id., Smith Sound, 539 *et seq.*
Villate, Capt. R., Conditions Géographiques de la Guerre, 559 §
Vinlandsreiserne, Eyktarstad-problemet og: M. N. Mjelde, 53 §
Viollier, on early amber trade, 485
Virgilj, G. A., 'Questione Rumeliota,' quoted, 317, 322, 331
Visher, S. S., on Variations in Rainfall and Tropical Development, 477 §
Volcanoes and Isostasy, letters by W. Werenskiold and C. W. Hobley, 89, 90
Volume and Mass in scenic effects, 433
Voyage— Under Sail; V— round Cape Horn: F. Reisenberg, 275 §
Vulliamy, C. E., Our Prehistoric Forerunners, 272 §

W.

WAHA tribe, Tanganyika Terr., 416
Wahabi fanaticism, Oman, 212
Wahlenberg Bay, North-East Land, geology, 115; ice conditions, 23, 35
Walcott, F. C., on Laguna Colorada, Puna de Atacama, 475 §
Wales, H.R.H. Prince of, Foreword to 'Resources of Empire,' 258 §; and Oxford University Arctic Expedn., 11
Wali Muhammad Baqir, Mt., Hejaz, 153; alleged site of rendering of Mosaic Law, 153
Walker, H., work on Himalayan glaciers, 333
Wallace, J. N., on Southesk's Journey through the West, 246
Walton, H., Livingstone, etc., 364 §
Ward, F. K., explorations in S.E. Asia, 5; through the Gorge of the Tsango, 91 (*title only*)
——, J. S. M., Resources of Empire: Textile Fibres and Yarns, 258 §
Wateko chiefs, Uha, Tanganyika Terr., 416
Waters, H. L., Lago di Garda, 358 §
Watkins, F. H., Handbook of Leeward Ids., 460 §
Watussi tribe, Uha, Tanganyika Terr., 412, 415, 416, 417
Wayland, E. J., Petroleum in Uganda, 362 §
Wegener, A., Origin of Continents and Oceans, 70 §
Wellsted, Lieut., journeys in Oman, 193, 219, 226
Welsh Border, River-terraces and Glacial Drift of, T. L. Pocock on, 565 §
Wembley, East Africa at, 176
Werenskiold, W., letter on Isostasy and Volcanoes, 89
West Indian and Ægean Ids.: Sir A. E. Shipley, 275 §
West Indies: G. Manington, 459 §
Wharton, L. C.: *see* im Thurn, Sir E.
Wetterhorn, scenic effects on, 433
Wheeler, J. F. S., of *Discovery* research Expedn., 42
White, L., on Salt Lake "Oasis," Utah, 474 §
Whitehouse, W. E., on Demographical Maps, 81 §
Wi Ch'u, J. H. Edgar on, 480
Wickham, Maj. R. S., on Water Transport of Timber in Burma, 472 §

Wieder, F. C., Hon. Corresponding Member of R.G.S., 75
Wiener's 'Prähist. Zeitschrift,' quoted, 499
Wigtownshire, Shore Vegetation, D. Sutherland on, 76 §
William II. and Anglo-German relations, 345
Wilson, Sir A., of Turco-Persian Boundary Commission, 234
Wineland Voyages, New Theory on: G. M. Gathorne-Hardy, 53 *
Wireless time signals, 242 *et seq.*
Witchcraft in Uha, Tanganyika Terr., 421
Withycombe, Capt. J. G., Recent Productions of Ordnance Survey, 533 *
Wollaston, A. F. R., new Member of Council, 9; Patron's Medal to, 93; responds to toast of Gold Medallists, 188; Sierra Nevada of Santa Marta, Colombia, 97 *; remarks on "Rocks and Glaciers of Mt. Everest," 314
Workman, W. H., and Himalayan glaciers, 333
World— From Pole to Pole: L. W. Lyde and C. M. Butterworth, 373 §; Nations of Modern W—: Sir H. Mackinder, 375 §; Missionary Atlas: *Ed.* H. P. Beach and C. H. Fahs, 371 §; Rolling Round W— for Fun: S. Hope, 373 §
Worsfold, W. B., Palestine of Mandate, 453 §
Wratislaw, A. C., British Commissioner with Turco-Persian Boundary Commission, 234
Wright, C. S., on Antarctic ice, 309
———, F. E., on Icelandic hot springs, 80 §

Y.

Yambulaq Jilgha valley, Kashgar Range, 388
Yarkand, river, source, 255–256; valley, conifers of, 396
Yarmuk, tributary of Jordan, salinity, 530–531
Yaru Chu, hydrology of, Himalaya, 300
Yelpakhtash, Kashgar Range, 401
Yengusta glacier, Nagir, 333
Yö Ri gorge, Himalaya, 300
Young, G. W., Pref. to Tissot's 'Mont Blanc,' 358 §
Yucatan Banks and Sargasso weed, 437

Z.

Zemu glacier, Sikkim, 304, 334
Zies, E. G., on Valley of Ten Thousand Smokes, 80 §
Zincography, 535
Zoo-geography— Vie des Animaux à la Surface des Continents: L. Germain, 274 §
Zumurrat glacier, Kashgar Range, 400
Zuwaira, Wadi, Dead Sea basin, 141
Zwemer, Rev. S., Travels in Oman, 193 201, 203, 208–209, 226

INDEX TO MAPS

EUROPE.

Early Amber trade routes. Bronze Age A— finds in Cent. E., 576 ; Do. in Italy, 490 ; Early Iron Age A— finds in Cent. E., 576 ; Do. in Italy, 493 ; Trans-Continental Amber routes, 484

ASIA.

Everest, Mt.—Sketch-map of Mt. E— from surveys of 1921 and 1924 Expedns., with geology added by N. E. Odell, 384
Kashmir. Sketch-map of Kolahoi Glacier, etc., 332
Oman. Folding-map to illustrate paper on "Some Excursions in O—" by Major-Gen. Sir P. Cox, 288
Palestine. Sketch-map of Mr. Philby's route from Dead Sea to 'Aqaba, 138
Pamirs. Qungur massif from survey by C. P. Skrine, 480
Tsangpo, sketch-map of part of, to illustrate Major Bailey's paper, 521
Turco-Persian Boundary, sketch-map of, to illustrate paper by Col. C. H. D. Ryder, 231

AFRICA.

Uha, Tanganyika Terr., sketch-map of, 413

AMERICA, NORTH.

Western Canada. Lord Southesk's route, as worked out by J. N. Wallace, 248

AMERICA, SOUTH.

Colombia. Sierra Nevada of Santa Marta, 98

ARCTIC.

Spitsbergen. North-East Land, 12 ; Provisional sketch-map of Geology of same, 115 ; Wahlenberg Bay, 20

ATLANTIC OCEAN.

Sargasso Sea. Chart and Diagrams to illustrate paper on, by Capt. C. C. Dixon, 480

ILLUSTRATIONS AND DIAGRAMS

ASIA.

Himalayas. Mount Everest, Rocks and Glaciers, 292, 293, 300, 301, 307, 308, 312, 313 ; Movements of Indian Glaciers, 334
Oman, Some excursions in, 196, 197, 197, 204, 205
Palestine. Dead Sea to 'Aqaba, 140, 141, 148, 149
Qungur, Alps of, 388, 389, 392, 393, 396, 397, 400, 401, 404, 405
Tsangpo, Photographs, between Chaksam and Tsetang, 520, 521
Turco-Persian Boundary Demarcation, 228, 229, 236, 237

AFRICA.

Abyssinia. Photographs of Lalibala and Gondar, 508, 509, 516, 517

AMERICA, SOUTH.

Andes. Ascent of Aconcagua, 44, 45
Columbia. Sierra Nevada of S. Marta, 100, 101, 108, 109

POLAR REGIONS.

Problem of Arctic, 540
Spitsbergen. Oxford University Arctic Expedn., 12, 13, 20, 21, 28, 29, 36, 37, 132, 133

GENERAL.

Geothermic Research at Borysław, 423, 424, 426

END OF VOL. LXVI.

PRINTED BY
WILLIAM CLOWES AND SONS, LIMITED,
LONDON AND BECCLES, ENGLAND.